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Committee on Foreign Operation Given This Issue

THIS issue of ELECTRIC RAILWAY JOURNAL is given over entirely, except for a condensed news section, to the advance publication of the report of the American Electric Railway Association committee on foreign operation. This committee, composed of James W. Welsh, Harley A. Johnson and Harry L. Brown, was sent abroad at the suggestion of President Britton I. Budd to study transportation facilities there in the interest of furthering the modernization movement in the industry in this country. The JOURNAL is glad to turn over its pages this week and give this extra prominence to a report which represents such a large expenditure of effort and money. The observations of the committee were so extensive and embodied so many points of interest to American railway operators that it was also thought desirable to give the report the fullest circulation in advance of the convention. For obviously, only a brief summary of the findings and conclusions of the commmittee can be given within the time available in the convention proceedings.

Not all of the matter treated in the report is to be taken, it is understood, as having the indorsement of the committee as desirable or practicable for application here, or as a commendable practice abroad. The committee members thought it desirable, however, to include an account of some things as a record of the present state of the art in the European countries visited, even though they might not consider them better than, or perhaps as good as, the corresponding practices in this country. In other words, so much of interest was learned that it seemed desirable to pass on a good deal of the information to the field, rather than to confine the report strictly to those ideas and practices which the committee believed to be improvements over American methods. An interesting thing about the expressions of opinion in the committee's report is that they represent the joint observations and conclusions of three men selected as being well versed in American practices, in the light of which their comparisons are made.

Much of the information gathered is presented by means of illustrations. This, together with the fact that the JOURNAL has taken some liberties in breaking the text matter up by headings and subheadings, will, it is hoped, make the report more readable and easier for reference work than if presented in the usual manner.

What We Can Learn from European Railways

To the
AMERICAN ELECTRIC RAILWAY ASSOCIATION:

THE Committee on Foreign Operation, after its short search in Europe for better practices and new ideas that might be put into use here in America to further the general program of modernization in the electric railway industry, finds it necessary to report that our foreign contemporaries have not a great deal to show that suggests material improvement. Yet some of the English railway men who have looked into our railway practices have gone back to their own properties with about the same feeling. This perhaps reflects as clearly as anything how difficult it is to adapt the practices followed in one country to the very different conditions prevailing in another. There are, however, some transportation practices in Europe from which we may derive lessons—some for which we might profitably take a leaf out of the book of our foreign brothers, and others which serve better to help us know what to avoid in the future.

We find in Paris and in the British cities, except London, a confirmation of the best American thinking with respect to the relations of the motor bus to the existing rail systems. In all of these cities the bus is being taken up more and more as an auxiliary and feeder to the tramway system. Nowhere is there any feeling that the bus can do the work of the tramway, and everywhere the tramway is being extended and developed. The bus is simply being fitted into the general transportation scheme wherever it can be used economically, even to the extent of displacing some few non-paying tram lines, as occasion arises to renew the tracks.

London offers probably the most interesting study of all the cities visited. The situation there is the exception to all of the accepted principles of transportation. In this one city we shall apparently have an opportunity to see worked out whatever merit there may be in no monopoly, no regulation, little co-

ordination, and plenty of competition. Private company buses are in competition with "pirate" buses, with private tramways and municipal tramways, and with the privately operated underground lines. All of these systems are giving more service than is needed or warranted at lower fares than they can afford, in the effort to hold traffic or take it away from the others. The result is that the tramways are losing traffic, the underground lines are barely holding their own, but the buses are building an enormous patronage. Even the last, however, is diluted by the operation of so many buses, again as a competitive measure, that it is doubtful whether the buses will continue to make money if they are doing so now. Temporarily, London people are enjoying an abundance of transportation service, but there must soon come a day of reckoning and some one will pay the bill. It will be the taxpayers for the municipal tramways and the stockholders for the private companies.

The main conclusion that may be drawn is this: The tramways are now handling some 1,000,000,000 passengers annually, and carrying nearly the whole of the extra surface traffic of the rush hours. The omnibuses are already carrying well over one billion passengers annually, but making no attempt to provide the extra peak-load service. Even on this basis, buses already virtually take up the entire capacity of the main arteries of travel. The most enthusiastic bus proponents in London said that buses *could* handle the entire surface transportation, including the billion passengers now handled by the tramways, only if an extensive street widening program were carried out. This was quickly admitted to be financially impossible. For the tram to be displaced would also mean a great expansion of the underground lines, and this was likewise said to be financially impossible. All of which is to say, then, that buses could not provide the entire surface transportation and that the tramways must remain. But if co-ordination is not soon brought about and the competition eliminated private enterprise will be forced out and the municipality will have to take up the burden and carry it on at the expense of the taxpayers. Recently a bill has passed Parliament which is a step in the direction of relief, as it gives the Ministry of Transport some authority in the bus service operated over the streets. But it is not yet in effect and it is somewhat doubtful just how helpful it will be.

Even under a proper system of co-ordination and regulation, the motor bus will have a very large place in London's transportation—a larger place than will probably ever exist in any American city. The reason is that the tramways are, and always have been, excluded from the central area comprising the principal business, theater and governmental activities. In fact, this is the reason that many Americans returning from London have the impression that "all" of London's surface traffic is handled by buses, as they have seen practically no tramcars.

Despite this great handicap, the tramways are serving an enormous patronage at a remarkably low fare, with a heavy excess of financial obligations to the city and government as compared to the bus, and doing it with losses surprisingly small. At the same time it should be said that the London General Omnibus Company has done a master job of supplying a service which the public wanted. Its original idea was to co-ordinate this service with that of its tram and underground lines, but the competition of independent bus owners has necessitated a wide expansion of the bus service into competitive territory as a measure of protection. This is now in varying degree jeopardizing all investment in rail service, and the future course of procedure and outcome are conjectural and not promising.

One point in which the tramways of England and Scotland clearly excel is the high standard of maintenance prevailing on the majority of properties. If one can overlook the fact that the tramcar there has undergone practically no development in the matter of design in the past twenty years or more, he cannot fail to admire the good mechanical condition and attractive appearance of the cars and the almost total absence of bad joints, noisy special trackwork and poor paving along the rails. The reason is that particular attention is paid to these features. It is almost the universal practice to wash every car in service every night, and to give each car at least a coat of varnish and such touching up of the paint as is needed once a year. Large plate-glass windows that are clean also enhance the appearance. A marring feature in London and some of the other British cities is the advertising carried on the outside of the cars. This is even worse on the London buses.

But while the exterior appearance and good mechanical condition reflect a real effort to attract the pedestrian to board the tramcars, little has been done to add to his comfort once he is aboard. Mostly longitudinal seats, and in any event, plain wood seats, continue to prevail. And only recently is any effort being made to speed up the service. This is being done in part by replacing the old-time motors with new ones on a few properties, though nowhere do they seem to be getting all there is in even the old motors in acceleration and running speeds. Another speeding-up measure noted is the beginning made in Edinburgh to arrange the cars so that both ends can be used for the movement of passengers, rather than to compel the entire ingress and egress to take place from both decks at the rear platform as is almost universally the case.

The single-truck car also seems still to satisfy most of the managements, and the "jazzing" (nosing) of these cars militates against any real speed of transit. The absence of air braking is notable, as is also the continued use of the electric track brake, despite the serious wear on the rail at stopping points. British tramcars are lighter per seat than ours, due mainly to the double-deck wood construction, use of single trucks largely, or in any event, the use of only two motors even on two-bogey cars. Generally speaking, British tramcars are better painted, cleaner, better maintained, lighter in weight and less noisy, but slower and less comfortable than our street cars in America.

The one important new idea with respect to car design comes from Paris, where 100 new cars have been placed in service which have the two motors mounted on the body, each driving one of the two axles by means of beveled gears. This design appears to offer an interesting means of reducing both the total and the unsprung weight, where it is possible to use a four-wheel car.

The most interesting thing about British track construction is that practically no cross ties are used. The rail is laid directly upon the concrete, with tie rods

to hold the gage. Lighter cars, lower speeds and less severe temperature changes perhaps account for the success of this lighter track construction. The committee would hesitate to express an opinion that such construction would stand up under American conditions. But it may be worth while to raise the question and to show and describe the details of construction, as is done in another section of the report.

Another feature of British track construction that is worthy of note is the process by which thermit rail joints are made under pressure with apparently very beneficial results.

Besides corrugation of the rail, which British tramway men appear to be bothered about as much as we, they have another serious trouble which is in the nature of a coning wear of both wheel and rail head, slanting downward toward the gage line. This contrasts markedly with the tendency of the American wheel tread and rail head to wear flat. As the coning becomes worse, the tendency of the single-truck cars to "jazz" increases.

The *in situ* treatment of rails is still in the experimental stage in Europe, but the experience thus far seems to indicate that it is at least of value in eliminating corrugation.

With respect to motor buses, the newer designs abroad still remind one of the early designs in this country, wherein the vehicle was an adaptation of a truck chassis rather than one intended in its whole make-up for passenger carrying duties. But despite this fact, buses are being far more extensively used in London and Paris than in any of our American cities, and they have much to teach us on the use of buses and chars-à-bancs in special tour services.

Steam passenger buses in Great Britain, to which there have been many references in this country in the last two years, have all ceased operation, and as far as the committee could learn, there is no steam bus operation in England and Scotland at present. The gasoline-electric bus is being tried out on a rather extensive scale in London, and in a limited way elsewhere in England. Their advantage is still a matter of doubt.

The use of trackless trolleys and the design of the vehicle are both still very much in the experimental stage in Great Britain and France. The committee was able to find no substantial enthusiasm for this type of transportation as compared with the motor bus. There has been a tendency on the part of some tramway managers to favor the trackless trolley because, with its lower center of gravity, they felt safe in making it an inclosed-top double-deck vehicle. Double decks and British tramway men are inseparable. But just recently, some inclosed-top double-deck motor buses have been placed in trial service which give promise of meeting requirements equally well.

Both in London and in Paris, the underground service is made attractive by the attention given to the interior appearance of the cars and the absence of severe congestion, even in the rush hours. There are, of course, nothing like the peaks to be handled in either of these cities that we have in New York or Chicago, for example, and the development of these systems has not been hampered by political abuse. The later London underground cars are particularly notable for their comfortable velour upholstered seats. The Paris underground seats are attractive in appearance, but are rather uncomfortable. Both the London and Paris subway cars are less noisy than our New York cars, but the reason is primarily that the windows are kept closed and many of the cars are built of wood—a practice which would not be permitted in this country. The London management has also made a particular study of noise reduction on its new steel cars and has met with some success. This, and the new attractive cars, and the use of escalators have been important factors in holding patronage in the face of the heavy surface competition. The deep level of many of the London subways militates seriously against the building of traffic. Thus, it takes a rather long ride to make sufficient saving in time to induce a rider to make the long descent to the rapid transit system. For this reason the underground lines are now being extended into outlying territories, and of course the distance fare helps to make this feasible. Another factor which favors the surface systems is that the speed of the underground trains in both London and Paris is not as fast as that of our New York and Chicago rapid transit lines.

One factor which greatly favors the operation of buses in London and Paris, and which should not be overlooked, is that there is nothing like the street congestion there that we have in our large American cities. This is due to the very much smaller use of private automobiles and to the absence of high buildings with the attendant heavy concentration of business people in a limited area. Thus, in both London and Paris, whatever street congestion there is, and it is fairly bad at certain points, is caused almost entirely by motor buses and taxicabs.

The regulation of street traffic is notable. There is almost no evidence of any control, yet traffic jams and collisions between vehicles are exceedingly rare. No use is made of any mechanical means of signaling traffic, not even the simple semaphore. Traffic largely takes care of itself, and the pedestrian, above all other users of the streets, must look out for himself.

The zone fare system used everywhere abroad produces a remarkable amount of short-haul riding. This suggests the thought that with the introduction of bus service in co-ordination with street railway service in America, it might be possible to start the bus off on a zone fare system, and use the bus to develop and handle short rides.

The general courtesy of British tramway, railway and bus platform men and their apparent desire to be friendly in their attitude toward passengers was another outstanding impression.

A general characteristic of travel in British cities, over which an American marvels, is the universal practice of permitting passengers to jump on and off moving cars, buses, and even underground trains. English women have certainly mastered the "face forward" rule. Half the time tramways and buses seem hardly to stop at all, or at least the interchange of passengers is almost wholly made while the vehicle is in motion. London's tunnel trains come in and leave the stations with several of the doors open. Many passengers hop off before the train stops and some even rush out, open the doors and jump on after the train has started. One would think that the companies would spend half their revenue in accident claims, but actually such expenditures are quite low.

JAMES W. WELSH,
HARLEY A. JOHNSON,
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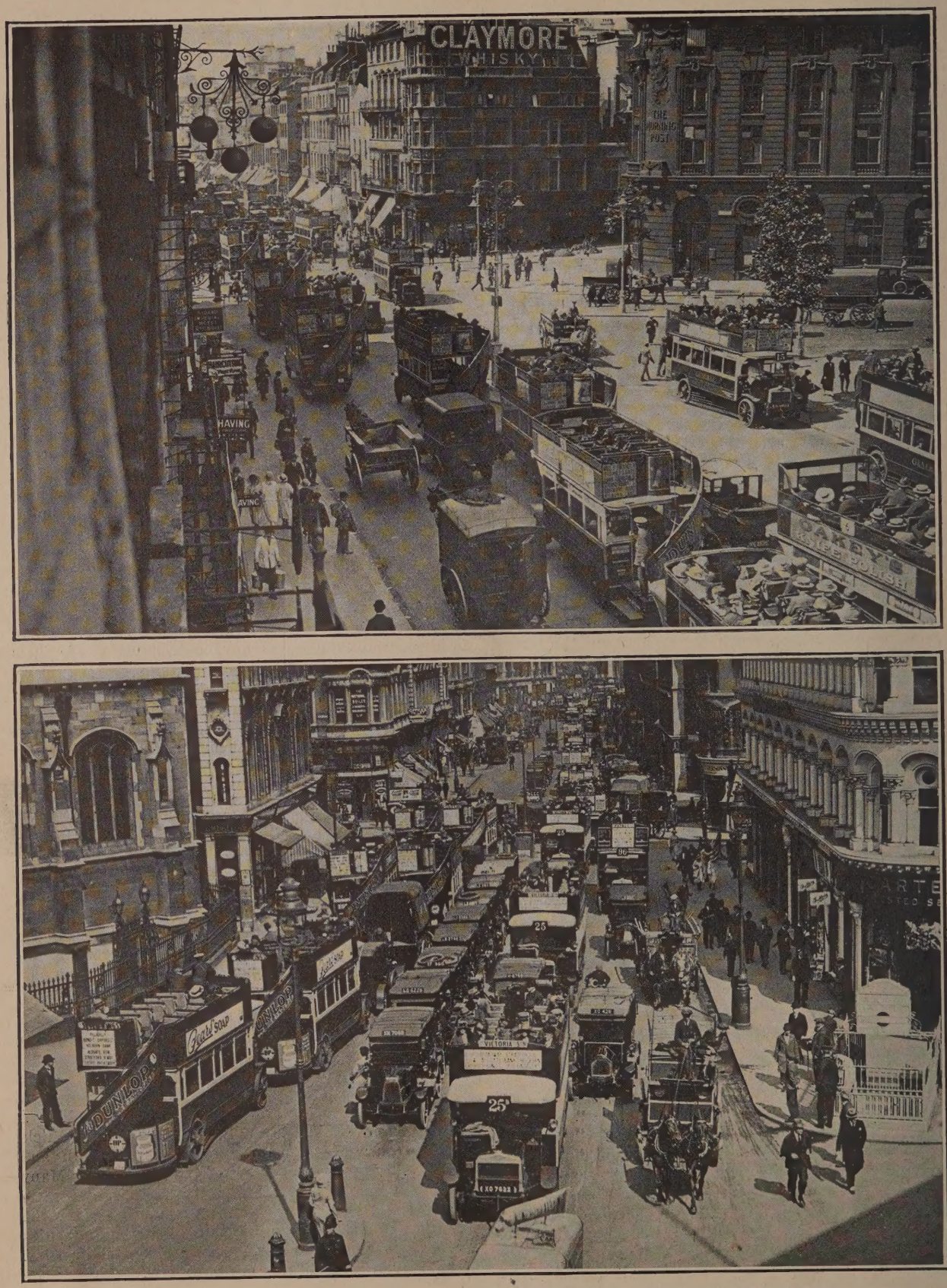

The Upper View Shows a Characteristic Traffic Scene on the Strand When Traffic Is Moving Normally. On Queen Victoria Street, Shown in the Lower View, Buses and Taxicabs Make Up the Major Part of Street Traffic

Observations on Foreign Practice

Committee on Foreign Operation of American Electric Railway Association Presents Report as Result of Study in England, Scotland, France and Switzerland—The Policies Abroad with Respect to the Relations of Tramway and Bus Are Told and Analyzed, the Designs of Rolling Stock Are Treated and Numerous Aspects of Transportation Across the Water Are Discussed

BY

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ELECTRIC RAILWAY JOURNAL

To the AMERICAN ELECTRIC RAILWAY ASSOCIATION:

Pursuant to the instructions of President Britton I. Budd, American Electric Railway Association, the committee on foreign operation submits the following report:

At the meeting of the executive committee on June 20, President Budd said he believed it desirable, in furthering the general effort toward modernization of the industry, to send a committee of three abroad to study foreign tramway, bus and railway operation, and bring back to the electric railways in America any ideas, which in the light of the committee's knowledge of American practices, seemed to offer possibilities of improving the service rendered the public by our companies. He felt that the association could probably not afford to pay the expenses of the entire committee on so extensive a trip, but said that his companies would send one man, if ELECTRIC RAILWAY JOURNAL would send another and the association the third. The executive committee approved of this plan and James H. McGraw, president McGraw-Hill Company, Inc., readily agreed to the proposal when approached by Mr. Budd.

The itinerary of the committee followed out in its studies in Europe is shown in an adjacent column. In general, this covered two weeks in London, one week in northern England and Scotland, one week in Paris and one week on the electrified railroads in Switzerland and southern France. The committee spent its time on each property looking into those things which appeared to be of particular interest, though it attempted, so far as time permitted, to go over the construction and operating practices of the company in general.

In practically every instance discussions were had with the management as to the operating results and trend of business, and its policy with respect to bus and trackless trolley in relation to the tramway. Information was sought as to any new construction or operating methods which the management considered in the nature of improvements that would interest American railway companies. The committee rode the cars, buses and trackless trolleys of each system, observed traffic conditions, inspected shops and carhouses, new track construction, power facilities and overhead construction, and made inquiry with respect to the relations between city authorities and tramway and bus undertakings. In its travels on the steam railways, the committee made particular note of the type of rolling stock used, the condition of the roadbed and its type of construction, courtesy of employees, general attention given to passengers, dining car and sleeping car facilities, speeds of operation, and any features tending to attract traffic.

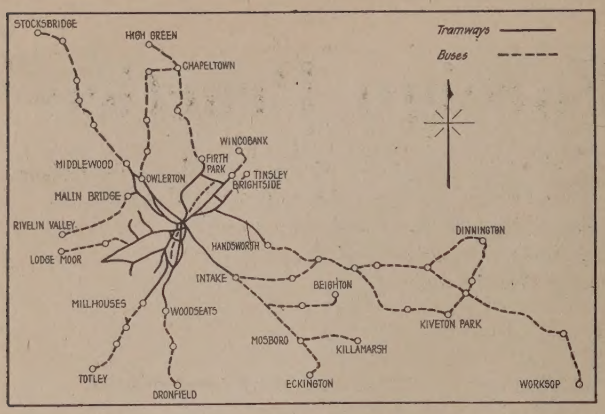
The committee naturally allotted a large share of its time to the transportation systems of Great Britain because of the greater similarity of the operation there with American conditions. The British electric railway men showed a splendid willingness and desire to give the committee all engineering and operating data requested and to assist it in seeing any part of the operation, not to mention the attentions which helped to make the visit pleasant. Not such a wealth of information was secured about the systems on the Continent, partly because of the handicap of the language and because many of the principal railway executives were unfortunately away on holiday.

The committee wishes to make acknowledgment of the great assistance afforded it through letters of introduction to European officials, which were supplied by a number of American railway executives and manufacturers. It wishes particularly to mention that Thomas W. Casey, vice-president National Pneumatic Company, placed his Paris Representative, Frank M. Delaney, at our entire disposal, and that he accompanied us on our calls upon railway people and acted as our interpreter and otherwise greatly facilitated our studies in France and Switzerland.

The Place of the Systems

THE question of whether the surface street railway is to be replaced with some other form of vehicle, and in general the place of tram, bus, trackless trolley and tube, are as live topics in Europe as they are in the United States. After looking into this phase of foreign practice particularly, the committee came away with the impression that the ideas about these questions are not quite as well crystallized abroad as they are here at home. Everywhere we went in Great Britain the tramway officials were more or less concerned about the bus and were studying its possibilities. A very few of them expressed themselves as feeling that the tramway would sooner or later be displaced by the road vehicle, but they were not able to give satisfactory answers in any case as to how the total traffic now being hauled by the tramways could be handled by buses. In no place is the bus handling the peak-load traffic, nor is any attempt being made to handle it with buses, not even in London where a total of 4,800 buses are in operation.

Some of the more progressive managers are bringing the bus into use in conjunction with the tramway, feeling that to have buses in operation is the best means of keeping control of the local situation and avoiding destructive competition. One might suppose that with municipal ownership, which exists in a majority of the cities in Great Britain, the local authorities would be able to prevent competition with

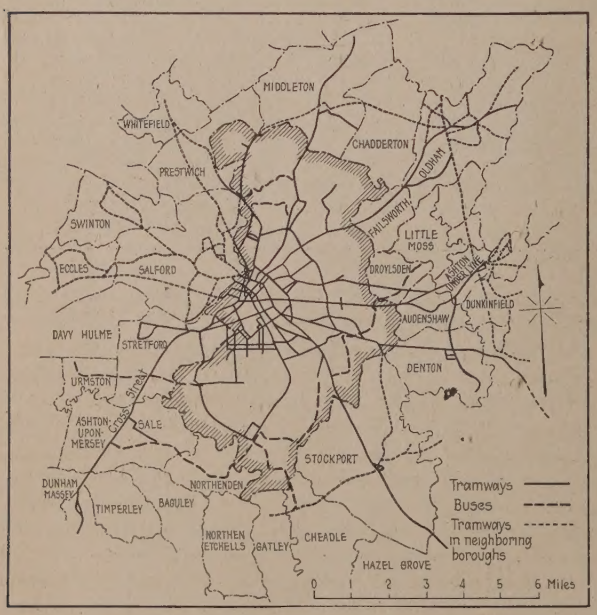


Buses extend many of the Sheffield Corporation Tramway lines to points outside the city, serving as feeders and keeping out competitive bus operators. They also make a good profit. No trackless trolleys here

their own systems. However, this is not the case. The authority to operate buses or any form of transportation over a given route is a parliamentary grant. While the local authorities are given an opportunity to try to show cause why competitive lines should not be established, the decision as to whether or not there should be additional transportation facilities rests with Parliament, and the local authorities not only can be overruled but have been. A local tramway concern cannot extend its own rail lines nor engage in bus operation without specific parliamentary authority for each undertaking.

In general, the tramway officials are installing buses as feeders to the tramway system or to replace a tramway line here and there when confronted with the necessity to rebuild the track and pavement on a route where the traffic is light. It is also usually in a case of the latter type that the trackless trolley has been installed, and this primarily because the overhead construction was already up.

Some British managers consider that the choice of



Tram and bus system of the Manchester Corporation Tramways and the neighboring connecting tram lines. No trackless trolleys here

Itinerary of the Committee on Foreign Operation

Wednesday, July 9....Sailed from New York.
Tuesday, July 15.....Arrived London.
Wednesday, July 16...London Underground Railways.
Thursday, July 17.....London General Omnibus Company, Chiswick Works.
Friday, July 18.....London Underground Railways.
Saturday, July 19.....London Underground Railways.
Sunday, July 20.....Trip over London, Brighton & Southern Railroad; London to Brighton and return, and tour of Brighton tram system.
Monday, July 21.....Tramways of London Underground Group.
Tuesday, July 22.....London Underground Railways.
Wednesday, July 23...London County Council Tramways.
Thursday, July 24.....London County Council Tramways.
Friday, July 25.....Inspecting London traffic and organizing data collected.
Saturday, July 26.....Same.
Sunday, July 27.....Sleeper London to Glasgow over London Midland & Scottish Railway.
Monday, July 28.....Glasgow Corporation Tramways.
Tuesday, July 29.....Edinburgh Corporation Tramways.
Wednesday, July 30...Leeds Corporation Tramways and Bradford Corporation Tramways.
Thursday, July 31....Sheffield Corporation Tramways & Motors.
Friday, Aug. 1.....Manchester Corporation Tramways.
Saturday, Aug. 2.....Birmingham Corporation Tramways and Motors.
Sunday, Aug. 3.....London. Rode long country bus route of L. G. O.
Monday, Aug. 4.....British Empire Exhibition, Wembley.
Tuesday, Aug. 5.....British Empire Exhibition, Wembley.
Wednesday, Aug. 6....London Underground, Acton Works.
Thursday, Aug. 7.....Articulated train over Great Northern Railway, London to Doncaster and return.
Friday, Aug. 8.....Non-stop run, 207½ miles, over Great Western Railway, London to Plymouth and return.
Saturday, Aug. 9.....London to Paris.
Sunday, Aug. 10.....Char-à-banc trip, Paris to Versailles and return.
Monday, Aug. 11.....Conference with officials of Midi and Paris-Orleans railways.
Tuesday, Aug. 12.....Metropolitan underground railway.
Wednesday, Aug. 13...Paris to Berne, Switzerland, via Chemins de Fer de l'Est.
Thursday, Aug. 14....Berne local tramway and Swiss Federal Railways.
Friday, Aug. 15.....Rode electric locomotive Berne to Thun; electric and electric-rack railways Interlaken to Jungfrauyoch and return.
Saturday, Aug. 16....Interlaken to Geneva; rode electric locomotives (three-phase and one-phase) Brigue to Lausanne.
Sunday, Aug. 17.....Geneva to Toulouse, France.
Monday, Aug. 18.....Toulouse to Tarbes; rode electric locomotive Tarbes to Lourdes, where inspected mercury arc substation. Night trip to Paris.
Tuesday, Aug. 19.....Arrived Paris 11 a.m.; inspected new multiple-unit equipment of French State Railway.
Wednesday, Aug. 20...Paris tramways and buses.
Thursday, Aug. 21....Metropolitan underground; shops and traffic study.
Friday, Aug. 22.....Called on Transport Commission.
Saturday, Aug. 23....Paris to Cherbourg; sailed for U. S. A.
Friday, Aug. 29.....Arrived New York.

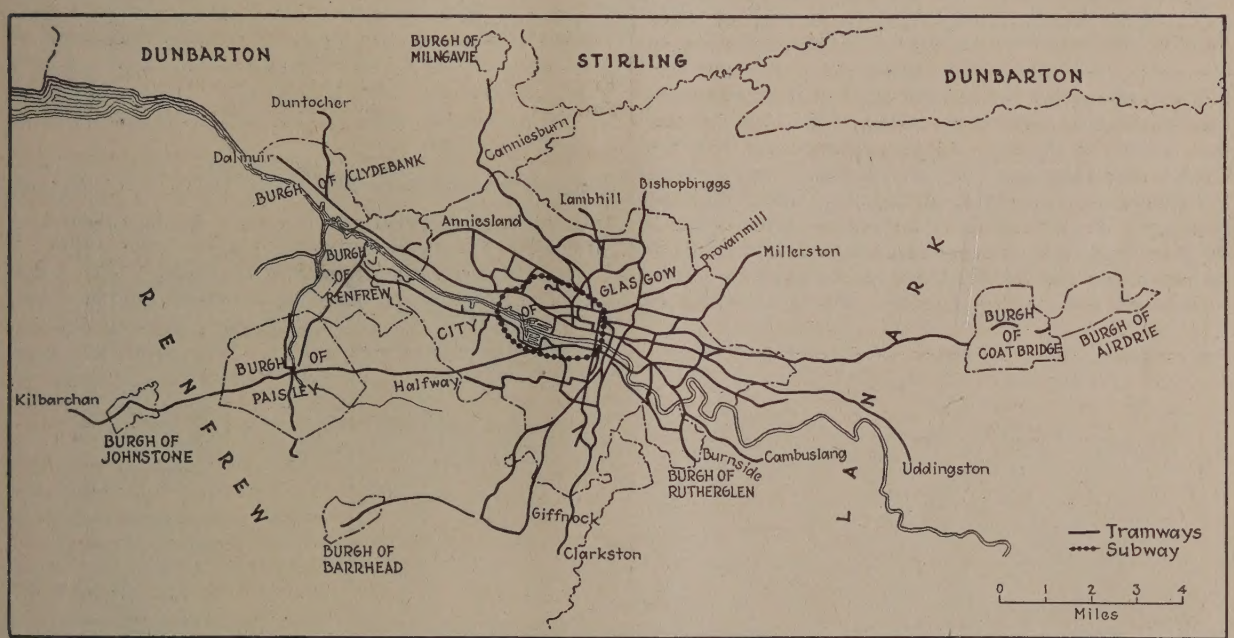
system is a matter of growth of traffic; that the bus should be replaced by the trackless trolley after traffic has reached a certain density, and then that the ultimate system will be the tramway when the traffic becomes dense. While a number of the tramway officials explain the possible field of the three in this manner, no such actual transition has taken place, and the in-between field of the trackless trolley is so limited that others think its place could easily be dispensed with by operating the buses a little longer than they should be operated from an economic standpoint, and beginning the operation of tramways a little earlier than they should be.

How Various Tramways Are Treating the Bus

IN VIEW of the absence of definite opinion as to the place of the bus, it is perhaps as enlightening as anything to tell what has been done up to date in each of the provincial cities visited in England and Scotland. In Glasgow, which has long been a city of particular interest because of the high density of traffic which is a parliamentary body, would not grant operating rights to a competitive undertaking, if application were made, on account of the completeness of the service rendered by the tramway. He had not made definite plans at the time of our visit as to where his new buses would be operated, but he feels that he should operate some buses in order to determine their field if there is one in Glasgow. The Glasgow Corporation has built considerable extensions to the tramway system since the war, some of these lines extending out into undeveloped territory and to public parks. A good deal of this work has been done as a part of the general program prevalent in Great Britain of providing employment, and in connection with the widening of streets and the extensive housing developments.

Edinburgh Citizens Showed Their Desire to Retain Tram

In Edinburgh, Scotland, the Edinburgh Corporation Tramways are now operating 86 buses of the single-deck, 32-seat, two-man type. The first operation of buses began three years ago when the rail lines were still being operated by cable. Several routes were operated entirely with buses and at first they made a

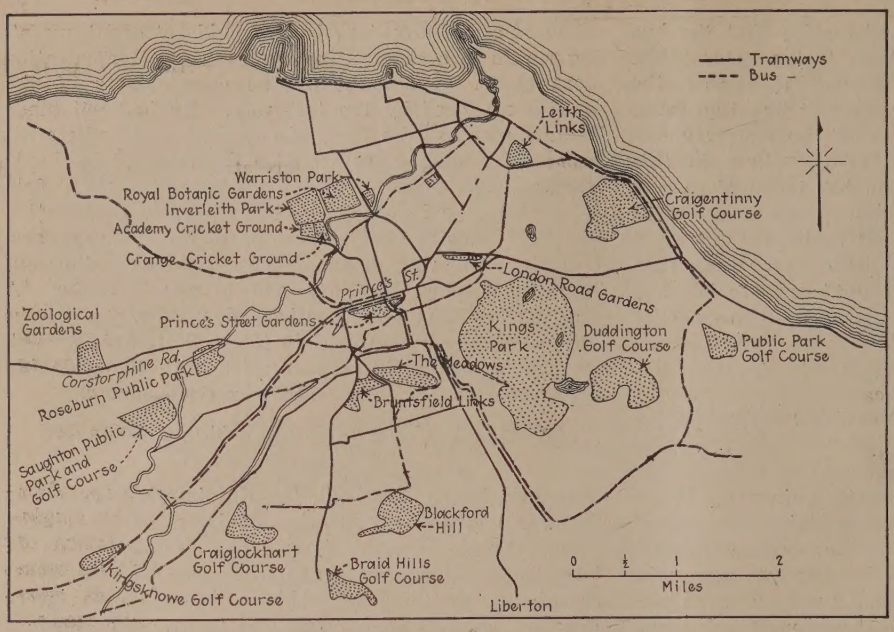


The lines of the Glasgow Corporation Tramways cover the city so thoroughly and provide so frequent and cheap a service that there has been no attempt at bus competition

and low rate of fare, the tramway has not placed any buses in operation as yet, but now has 14 on order. Furthermore, there is no bus competition there as yet. In view of the competition which has sprung up in various other cities, it may be interesting to point out certain reasons why there has been none in Glasgow.

In the first place, the rate of fare is extremely low and the frequency of service is very close and nearly all of the available streets are occupied with tram lines, so that the possibilities for profitable independent bus operation are obviously limited. James Dalrymple, general manager of the Glasgow Corporation Tramways, expressed the belief that the Ministry of Transport, strong appeal, but later the public reacted strongly against them. This was because of the vibration, noise and slow loading and unloading. Some of this operation was over roads paved with granite block, and as the buses were equipped with solid tires, the vibration was bad and the riding uncomfortable. The buses were also unpopular because their limited capacity made it necessary often to leave passengers at various corners, who then had to wait for the next bus or walk.

Some of the dissatisfaction was overcome by the use of pneumatic tires, which did away with the vibration and also saved in gasoline consumption and body maintenance, and the tires cost little more. But the most



Edinburgh Corporation Tramways system

This shows the relation of tram and bus routes. Buses operate over Prince's Street in the rush hours, paralleling the tram line on the principal thoroughfare as a means of increasing the street capacity, and also on several routes into the outskirts of the city.

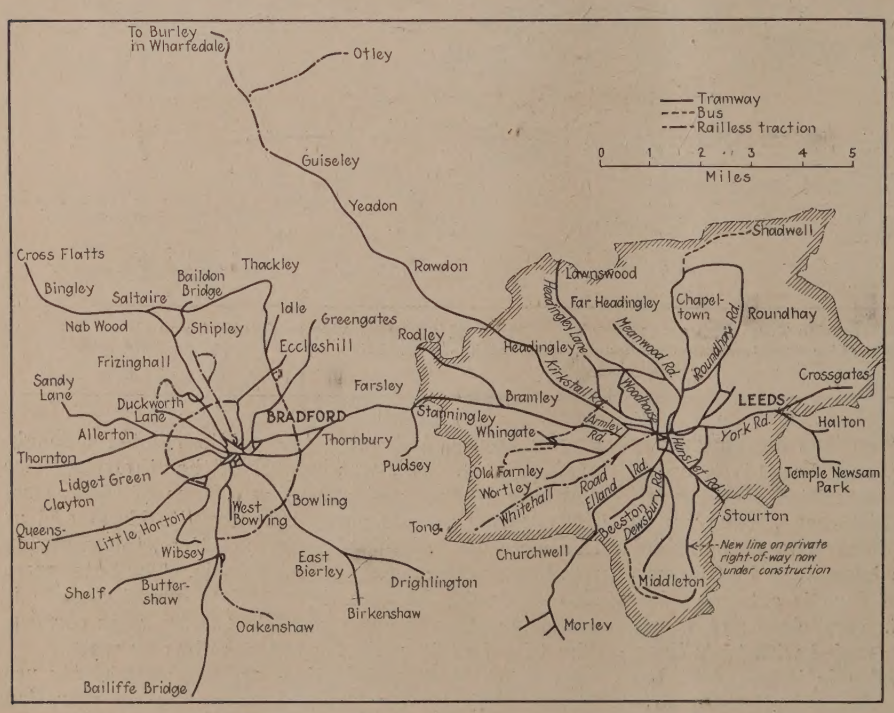
the total revenue was substantially better, as there were fewer walkers.

The opinion of R. Stuart Pilcher, manager, is that there is a general field for buses everywhere, but he does not think that they will do away with the trams. The most serious disadvantage is that not enough buses can be operated to handle the rush-hour loads. The buses are being used in Edinburgh now not only as feeders to the tram lines, but to parallel the tramway on Prince's Street, which is the main thoroughfare, during the rush hour as a means of increasing the capacity of the rail line on that street. The company is also operating 15 pneumatic-tired chars-à-bancs in tours from 10 to 20 miles out of Edinburgh and charging a fare of 1s. to 2s. These chars-à-bancs are not run unless a three-quarter full load is available. Last year some 50,000 passengers were carried on char-à-banc trips at a profit of £4,000.

interesting part of the experience with these early type buses, which were not all that might be desired, led to a clamor for tramway lines rather than bus lines and probably was a factor in the decision to electrify all the cable lines. This has been done during the last two years. When some of these bus routes were replaced by the electric tram, the tramcars carried all of the passengers who offered themselves, even with a 1-minute longer headway, and

LEEDS OPERATES BOTH BUSES AND TRACKLESS TROLLEYS

The Leeds Corporation Tramways, Leeds, England, is operating 14 trackless trolley buses over 8 miles of route. The corporation is also operating eight motor buses on lines which serve as extensions of the tram lines to new housing developments. The principal trackless trolley installation in Leeds replaced a tramway line and was put in when the corporation was faced with the necessity to rebuild the track. This line was operated with a 5-minute headway of the tram, though not more than a 10 or 15-minute headway was needed to handle the traffic. Other trackless trolley lines were installed to provide crosstown service or extensions to the tram lines. The trackless trolleys that are used in Leeds seat 60 passengers, are of double-deck design and weigh 7 tons 12 cwt. (17,024 lb.). The tramcars seat 56 passengers on the two decks and weigh 11 tons 4 cwt. (25,088 lb.). The corresponding energy consumption is 1.6 kw.-hr. per car-mile for the trackless trolleys and 1.78 kw.-hr. per car-mile for the trams. An effort is made to carry only a



The neighboring tramway systems of Leeds and Bradford, showing trackless trolley routes in both cities and bus lines in Leeds

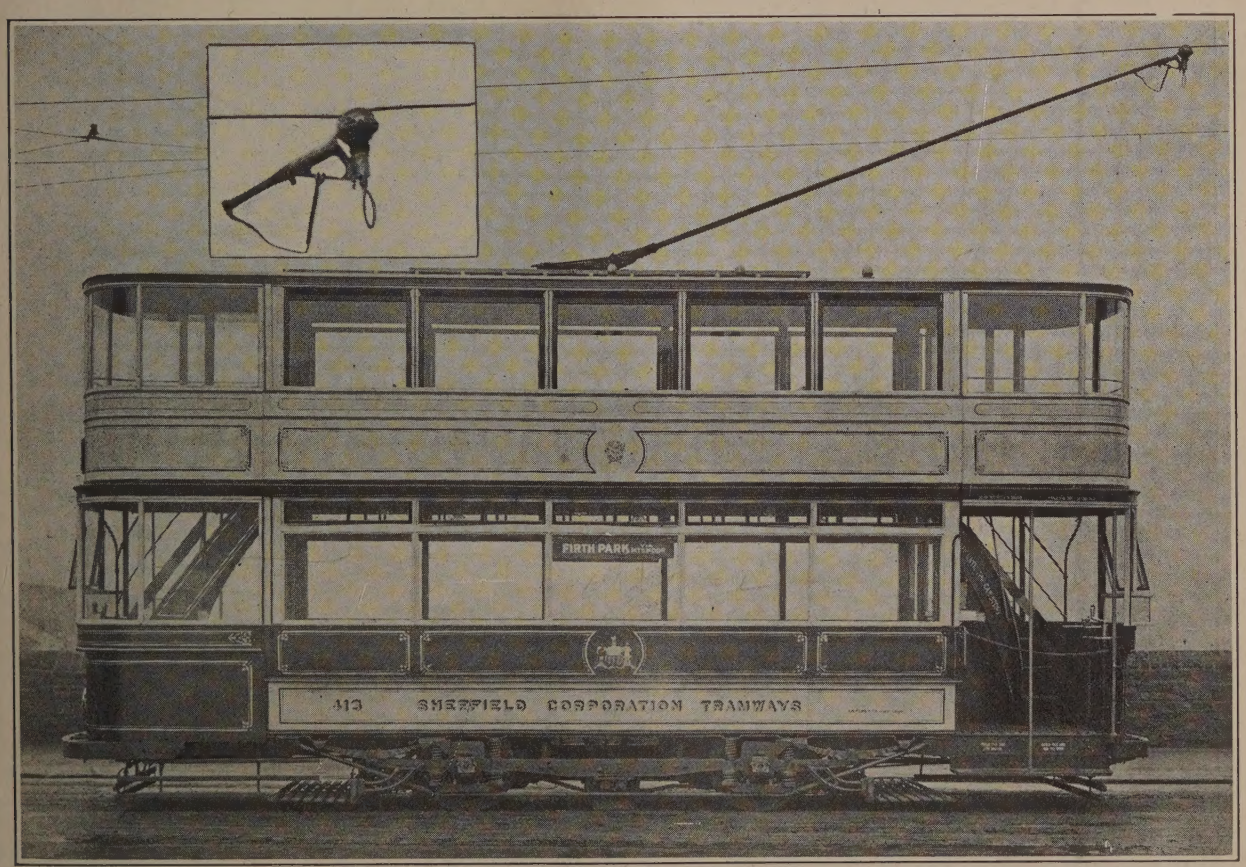
seated load in the trackless trolley, while a standing load of 12 passengers is permitted on the trams. The maintenance cost of the trackless trolley has been found to be just about the same as that of the tram. No road maintenance tax is paid for the trackless trolley except the vehicle tax, which is based on the carrying capacity. The opinion of the Leeds management is that where the traffic on a given line required not closer than a 10-minute service, the trackless trolley is the best vehicle, while buses should be installed for headways of 25 or 30 minutes.

Another instance came to light in Leeds of the people preferring the tramway where the headway was long, because it had the capacity to carry all the passengers who offered themselves. This was on a route where three one-man, 20-seat, pneumatic-tired buses were providing the service. It was frequently necessary for the bus to leave some of the passengers because of the definite limitation of its capacity.

The corporation is now engaged in the building of a 3½-mile extension of the tram system to the village of Middleton, primarily to take care of the week-end and holiday riding to a park and also to serve a new housing development. The headway required normally will be very infrequent, but considerable capacity is needed on these heavy days. The fact that there is no direct road between Leeds and Middleton was given as the primary reason for building a tram line rather than to operate buses. This means that the tram line is being built on private right-of-way with open-type track construction. An interesting sidelight in Leeds is that J. B. Hamilton, manager of the corporation tramways, is also in charge of the street improvements and street cleaning and is able to correlate the tram and road work.

TRACKLESS TROLLEYS BUT NO BUSES IN BRADFORD

R. H. Wilkinson, manager of the corporation tramways in Bradford, England, is a great believer in trackless trolleys and has 20 such vehicles of various designs in operation. He believes that trackless trolleys could be used practically anywhere. No motor buses are in use by this corporation. None of the trackless trolley routes is paying, however, and Mr. Wilkinson explained that the reason is that all of them are operating on routes where the traffic is so light that there is no possibility of their paying, but they provide a service demanded by the city. They are operated on crosstown lines and as extensions to tram lines. It costs about the same to operate a trackless trolley as a tramcar, exclusive of fixed charges. A road tax of £70 a year is required for each vehicle. Mr. Wilkinson believes that it will be possible to handle any traffic with the trackless trolley as well as with the tram, except where there are bad gradients. He says that the trackless trolleys are being kept in service absolutely on their merit, but comments also that the people of Bradford do not like them and that the tramway committee is not inclined to



Standard Type of Car Used on the Sheffield Corporation Tramways

This car, fitted with plate glass windows and curved plate glass vestibule windows, upper and lower deck, is one of the most attractive cars seen abroad by the committee. The absence of advertisements on the outside of these cars, and on the Edinburgh cars, which are present on the trams in many cities of Great Britain, greatly enhances the appearance. The Sheffield cars were particularly inviting in appearance when lighted at night, on account of the glistening of the curved vestibule windows, which appeared to be highly polished on every car. This Sheffield car seats 70; weighs 13 ton 7 cwt. (29,904 lb.), and is equipped with two 50-hp. motors. The inset shows the swivel harp used generally in England.

authorize any further extensions of them. Some light may be thrown on this by reference to the design of these vehicles, which is discussed elsewhere.

An effort has been made by the management to secure authority from Parliament to operate motor bus lines into outlying territories, but this has been opposed by the surrounding communities on the ground that they think that if the corporation tramway of Bradford were to supply them with transportation service, this would tend to bring about their absorption into the city. Nevertheless, they want bus service into Bradford and would welcome it if supplied by a private company. The committee thought this was a rather interesting sidelight on municipal ownership.

While there is no bus competition in Bradford at the present time, there are a large number of buses operating out into the country from the ends of the tram lines. The railway out to the city limits takes thousands of passengers who are picked up there by buses and delivered to their homes outside the city. If these buses should come into the city, even though they did not pick up any local city passengers, they would nevertheless take away from the tramway a very large patronage which it now has.

On this question of competition, the opinion was expressed here in Bradford that if application was made for operation of buses by a private enterprise within the city, which of course would be opposed by the tramway authorities, the Ministry of Transport would probably grant the right, because the government is now tending to favor private business. The comment was also made that municipal works in Great Britain have reached their zenith.

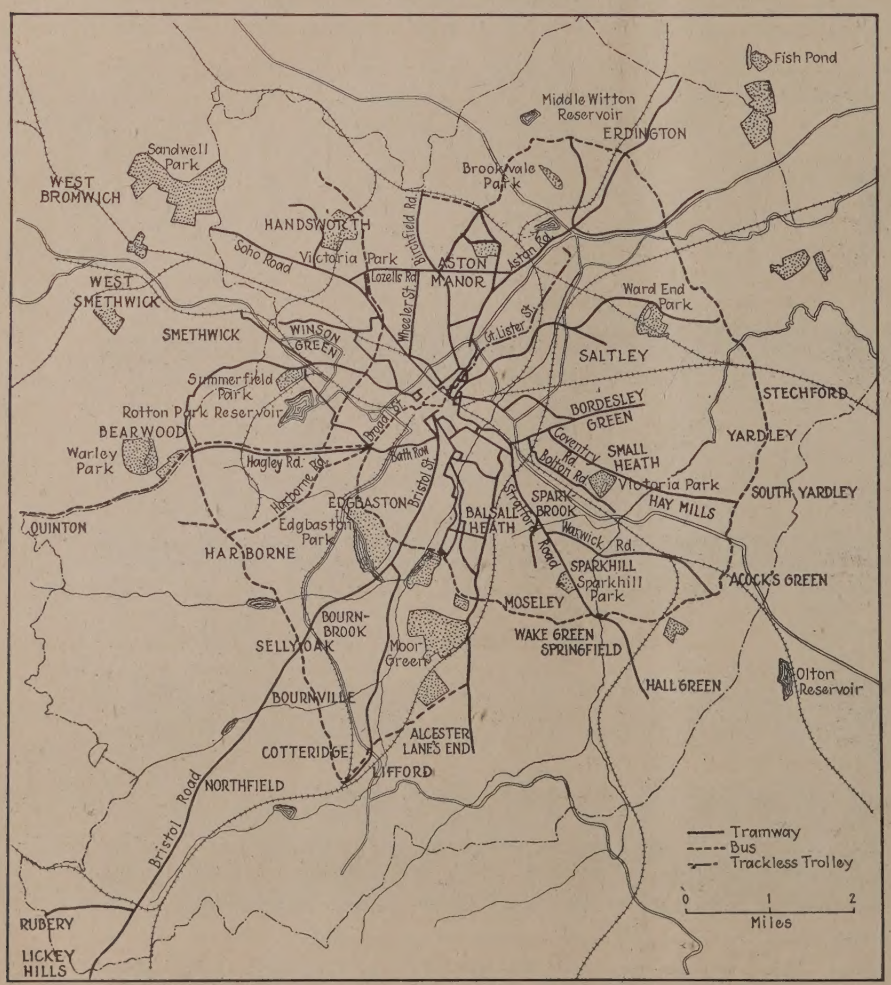
A Progressive Development of Both Tram and Bus in Sheffield

In Sheffield, the tramway-bus situation is particularly interesting. Under the direction of A. R. Fearnley, manager Sheffield Corporation Tramways and Motors, not only is the tramway being used to its best possibilities, but an extensive use of buses is being made in co-ordination with the rail lines. There are now 56 buses in use on services which are very largely extensions of the tram lines and which do not compete with the rail lines. These bus lines are not only serving as good feeders to the tramway system and keeping out competition, but they are also showing, as a whole, a substantial profit in themselves. Mr. Fearnley commented that the bus undertaking is financing itself out of revenue. Trackless trolley powers have been obtained from Parliament but have not been exercised, Mr. Fearnley feeling that economically there is no particular place for this type of vehicle.

Mr. Fearnley is not at all of the opinion that the tramway is a back number, but considers that the bus business is very attractive and that the tramway people should get into it and prepare to dominate the local transportation field. If the motor bus is to be the vehicle of the future, the tramway people should be the ones to operate it.

As evidence of the faith in the tram, the Sheffield Corporation Tramways has renewed 50 per cent of the trackage in the last 5½ years. An extension 1¼ miles long is being made this year, and three lines were extended last year. The extension being made this year is in connection with a road-widening project and the tram line takes the place of a bus extension of a tram line, because the people did not like to have to transfer from tram to bus, and the management did not want to parallel its tram line for 2½ miles with buses.

Nevertheless, in every place where rebuilding of the tracks becomes necessary, the management is giving serious consideration to the advisability of installing buses rather than to put the new investment into track. In one case this decision has been made. The Petre Street tram line,



Birmingham Corporation Tramways system comprises tram, bus and trackless trolley. The bus lines are largely circumferential and all within city limits

Latest single-deck 32-seat bus of the Sheffield Corporation Tramways, which is typical of the newest designs of buses manufactured in England

although a good paying rail route, with a 10-minute and 6-minute headway, is to be replaced by a bus service with a 5-minute headway. Use will probably be made of a new type of double-deck bus seating 52 passengers and having the top inclosed, of which the company now has one trial bus, described elsewhere. The high cost of replacing the track was one factor in the decision to substitute buses, but another one was that the tram line was short and had a rather poor terminus, while the bus line, which will be substituted for it, will extend some distance farther out and reach a better terminus. The street over which this extension of route will be made was rather too narrow to permit of satisfactory rail operation.

Except for this new bus line which will shortly be installed on Petre Street and one other bus line inside the city, as shown on the accompanying map, all of the bus routes operated by the Sheffield Corporation Tramways extend outside of the city and are distinctly in the nature of extensions of and feeders to the tramway system. Mr. Fearnley considers that these outlying bus routes are a benefit to the tramway system and to the city, even if the operations have to be conducted at a loss. In fact, one poor tram line in Sheffield has been turned into a paying line as a result of business brought to it by the corporation's own buses and by competitive buses operating into the country.

The total revenue derived from bus operation for the year ended March 31, 1924, was £96,351. The operating expenses were £72,973, leaving a net balance of £23,378. The deductions for fixed charges, sinking funds, renewals, etc., and the net income were as follows:

Interest	£1,476
Sinking fund	6,188
Income tax	62
Renewals	6,188
Total deductions	£13,914
Net revenue	£23,378
Total deductions	13,914
Net income	£9,464

This net income was expended for new buses, garage facilities and other capital expenditures.

*By parliamentary act, investment in buses by municipal systems must be amortized at the rate of one-eighth a year; tramways, one-twenty-fifth a year.

The figure for bus mileage operated during the year is confidential, but it may be said that the total expense, including operating expenses, interest, sinking fund,* renewals and all other charges, figured for both bus and tram, showed a total cost of 3d. per mile less for buses than for trams. This, however, is not on an equivalent seating capacity basis, and if this is taken into account, the cost per passenger would show up much more favorably for the tram.

In considering this matter of seating capacity, the newest type Sheffield cars seat 70, while the new inclosed-type double-deck bus seats 52, and it is expected that future double-deck buses will seat 60. The 52-seat bus must pay a license of £70 a year. The maximum speed of both tram and bus is about the same, but the buses make about 1 m.p.h. higher average schedule speed on account of operation on country roads.

The Tram Is the Thing in Manchester with Limited Field for the Bus

The opportunity for operation of buses in co-ordination with the rail lines by the Manchester Corporation Tramways is rather more limited than that of most of the British tramway systems. On five-sixths of the circumference of the city the lines of the Manchester corporation connect with other tram lines, so the only place where buses can be operated without being in competition is in the south sector of the city. Here the corporation has 30 buses in service, including those few which are operated in crosstown service. As indicated, the lines in this south sector of the city are in the nature of extensions of the tramway system.

Henry Mattinson, general manager, expressed the opinion that buses may be used to advantage as feeders, but that he has not the slightest doubt that the tramway is the best means of handling the major transportation service. Buses cannot be operated successfully except at practically double the rate of fare on the tramways. Furthermore, nearly three buses would have to be

This is typical of the present day London tram car, which seats 78 passengers and is equipped with double maximum traction trucks and magnetic track brakes

operated for one tram. He considers that independent buses cannot compete with the tramway systems at an equal rate of fare, and that bus lines will ultimately become tramway lines as the territory develops.

As to the field of the trackless trolley, none of which is in use in Manchester, Mr. Mattinson thinks that there may possibly be an economic field for it between bus and tram, but this field is so narrow as to be eliminated in many cases. He thought that the principal opportunity to use it would be where a tram line was to be replaced by some form of road vehicle, and here, with the overhead already up, it probably would be more economical to operate trolley buses than buses.

The soundness of the Manchester tramway position is reflected in the construction program which is being carried out. During the year ended March 31, 1924, the track mileage was increased by 8 miles, or nearly 4 per cent of the total mileage. A number of additional track extensions are now under construction, and petitions are before Parliament for authority to build others in connection with housing developments. The corporation is also rebuilding 30 of its single-truck cars a year into larger double-truck cars with a seating capacity of 82. On rebuilding, the cars are also equipped with new motors. These rebuilt cars weigh 14 tons and are legally permitted to carry 12 standees, but they easily carry 100 passengers.

BIRMINGHAM BUSES IN CROSSTOWN SERVICE; TRACKLESS TROLLEY REPLACES TRAM ON NARROW STREET

The Birmingham Corporation Tramways has 78 buses and 12 trackless trolleys in operation. The buses, except for one experimental inclosed-top double-deck type, are all of single-deck design, while the trackless trolleys are all of double-deck design. The latter seat 52 passengers, as does also the double-deck bus. The double-deck bus and the trackless trolley weigh just about the same.

The motor bus services of the tramway corporation are all within the city limits and are of a circumferential or crosstown nature, though some of the routes run into the center of the city. Outside of the city there is a very large bus undertaking by an independent private company, but there is no competition. The tramway has an agreement with the bus company whereby the corporation does not run buses outside of the city and the independent bus company does not pick up any city passengers, although it brings the suburban passengers into the center of the city. The independent company is big enough to prevent competition outside of the city, and the tramway service is so complete as to do the same thing within the city. If an independent bus picks up a strictly city passenger, it is required to charge him twice the tramway fare and turn over to the tramway the usual fare. These circumferential bus services of the tramway were reported to be paying, and it was said that the suburban traffic of the independent company was growing very rapidly.

In 1921 the corporation substituted trackless trolley operation for one of its tram lines, the occasion having arisen to rebuild the track. This tramway line was a single-track route with sidings, and the best that could be done was to provide a 5-minute headway. The street was not wide enough to put in double track, so the corporation decided to try out trackless trolleys, as these could be run at any headway and reconstruction of the track also avoided. This line extended through a thickly populated combined residential and business district of lower class and really needed better than a 5-minute headway of trams.

During the first year of operation of trackless trolleys, 46 per cent more mileage was operated, producing 27 per cent increase in gross receipts and 37 per cent increase in net revenue. The detailed comparison between the last 12 months of tram operation on this line and the first 12 months of trackless trolley operation follows:

	Car-Miles	Receipts	Gross Profits
Railless, 12 months ended March 31, 1924	339,396	$123,790.53	$40,114.19
Tramcars during previous 12 months	232,165	97,672.72	29,302.79
Increase	107,231	$26,117.81	$10,811.40
Percentage increase	46.2	26.7	36.8

Alfred Baker, general manager, considers this the first instance where trackless trolleys have been installed where they really had a chance to make a showing. Both the management and the passengers are well satisfied with this trackless trolley service. The service is fairly fast, the vehicles give a sensation of more mobility than many of the trackless trolleys and they ride well.

Mr. Baker was very positive in his views on motor buses. He believes they are of great value as feeders and extensions out into districts not yet thickly populated. With traffic built up sufficiently, bus lines will later be replaced with tram lines. He had no idea that the motor bus will replace the tram for handling traffic in the built-up portions of cities. There are certain special cases where the trackless trolley may also work in. Buses require a higher fare, because while the operating expenses are about the same as for trams, the seating capacity per vehicle is smaller. The peak load in Birmingham would militate against any possibility of such substitution of buses. This is illustrated by the fact that during the non-rush hours two-thirds of the tramcars are in the carhouses from 10 a.m. to 5 p.m., and are all out during the two rush hours. Applications are now before Parliament for permission to build 6 miles of tram-line extensions. The company is also gradually replacing its 54-seat single-truck cars with 70-seat double-truck cars.

This sums up the conditions surrounding the use of the bus and trackless trolley in the cities outside London visited by the committee. These situations are more nearly comparable with those which prevail in most of our American cities than is that in London. The London situation is so very different, really unique, that the committee feels this must be discussed entirely by itself. In order to get a fair view of the problem, one must first have a general idea of the variety of facilities that are serving London and of the great extent and overlapping of the various systems and the many other complicating features.

Air washers and ozonizers used heretofore in ventilating the London Underground tubes are being done away with. There is so much iron rust and dust in the tubes themselves that it seems unnecessary to go to such great lengths to introduce absolutely pure air. The tubes are ventilated the year around except on a few very cold days. In summer the temperature in the tubes ranges from 70 to 77 deg. About half of the heat is dissipated by convection and conduction through the walls and the remainder is taken care of by the ventilation.

Omnibus terminal opposite Victoria railroad station, London, which is typical of numerous bus terminals at important loading points in various parts of the city

London's Complicated Transportation Situation

Buses, Trams and Underground All Bid for Patronage—Competition Keen Between the Systems Under Same Management, Between Municipal and Private Management and Between Bus Company and "Pirate" Buses—For the Moment Londoners Have an Abundance of Service of All Types

LONDON, with its extensive systems of tube and tunnel railways, trams and omnibuses and suburban steam lines, all working in a maze of competition, has a transportation situation for which there is probably no parallel in the United States. It is so complicated that no one seems to have a clear conception of the future course of development. But this much is evident: If there is any merit in competition, London is the place where we shall see the result worked out. Meantime, the people of London are getting the benefit (at least temporarily) of an enormous duplication and excess of service. The competitive aspect here, with bus, tram and tube often on the same street, is the more unusual because the competition is in part between systems under the same management, as well as between separate managements, and also between private and municipal enterprise, and between organized companies and irresponsible, individual bus operators.

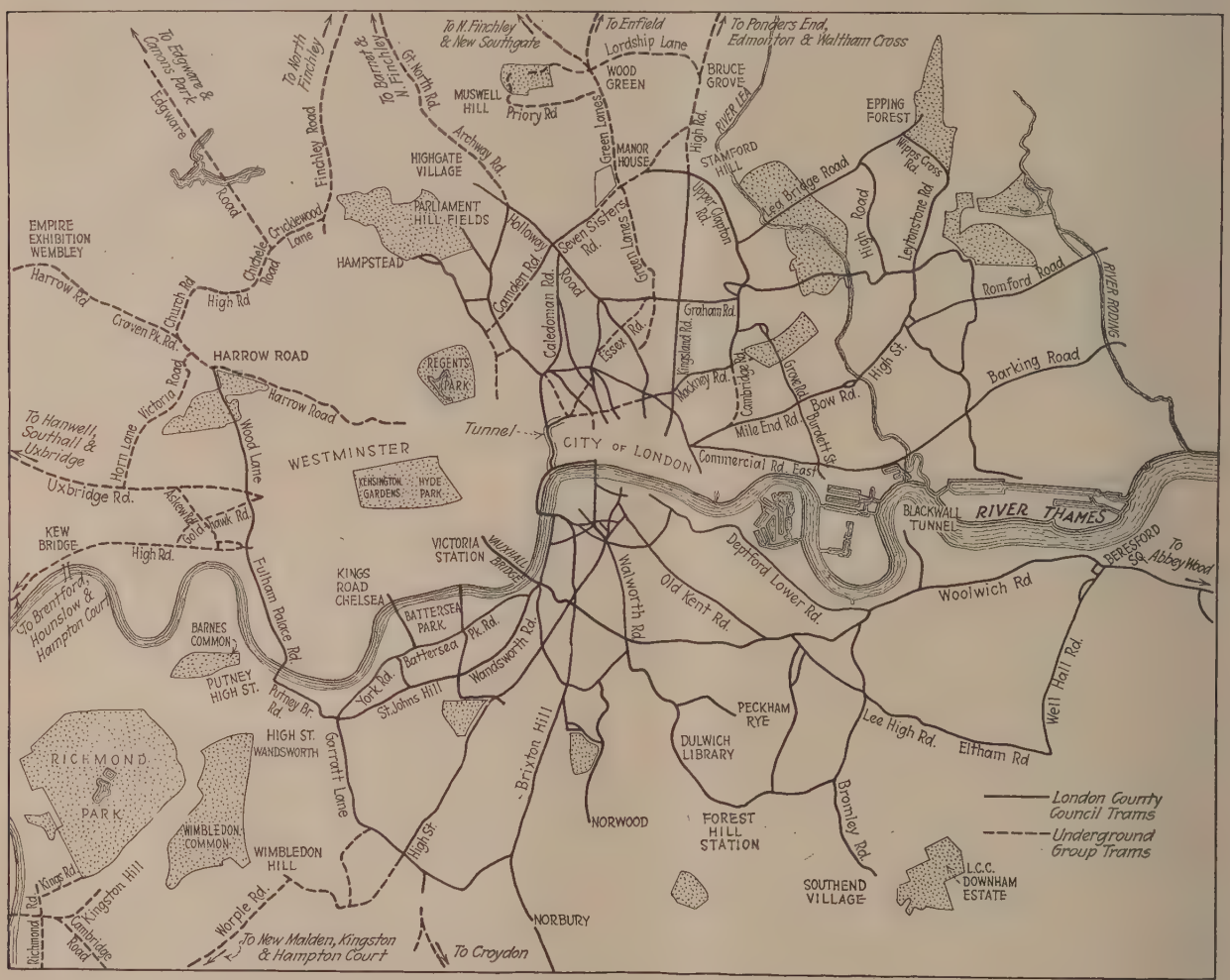
First, there is the London Underground Group of transportation systems, under one management, which comprises most of the underground tube and tunnel railways; 114 route-miles, mostly double track, of tramway lines, and a system of buses having a network of 753 route-miles completely covering the city. Then there is the Metropolitan underground railway, a private company, and the London County Council Tramway System, a municipal undertaking. The latter is the major surface rail system and comprises 164 route-miles, practically all double track. The London County Council operates 2,032 cars, the Underground group tramways 553 tramcars—a total of 2,585 cars. There are also a number of minor municipal systems in outlying sections of the city. The London General Omnibus Company operates 4,500 buses, being a subsidiary of the Underground. Then there are some 300 individually owned buses, usually spoken of as the "private" buses. The steam road suburban traffic is also of considerable moment, as each railroad comes into its own station, these stations being rather widely separated and located in various parts of the city, and each having a suburban traffic. An estimate of the passenger traffic handled by each of these several systems, as furnished by Frank Pick, assistant managing director of the Underground Group, is given here:

DIVISION OF TRAFFIC AMONG VARIOUS SYSTEMS
LONDON AND SUBURBS

		Annual Passengers
London Underground Group	Tubes and tunnels (including Metropolitan Ry.)	568,000,000
	Tramways	190,000,000
	Motor buses	1,214,000,000
London County Council Tramways		719,000,000
Suburban tram systems		126,000,000
Suburban steam traffic		343,000,000
		3,160,000,000

Looking at the map of the London Underground, reproduced herewith, it is difficult to imagine what could

have determined so intricate and haphazard a mesh of tube and tunnel railways. Obviously, there was no plan behind it. The lack of a plan is explained at once by the knowledge that the present underground system is the unification under one management, except for the Metropolitan Railway, of numerous independent undertakings, each built by its special promoters without any reference to the other railways, and only governed by what seemed to offer a profitable route. Some of the lines were built so that they competed with existing tube or tunnel railways, for in those days Parliament through routing of service between parts of the system, and the very deep level of much of the system is an almost insurmountable obstacle to traffic building. This is better appreciated when it is known that one can make as quick time on bus or tram, up to 4 miles, as he can on the tube, taking into account the time consumed in booking (buying a ticket) going down to the train platform and then getting up out of the tube again. The underground lines are thus quite susceptible to the competition of the surface systems. Accordingly they are being developed now largely with



The tramways of London. Note the absence of any surface rail lines in the central business area, known as the old City of London and Westminster

definitely encouraged competitive transportation. Similarly, each company had its own ideas about the kind of rolling stock it should use and the dimensions of its tube or tunnel. Consequently, London now has an underground system that can never truly be consolidated.

The Underground management is therefore confronted with the task of joining the various lines as far as possible by numerous interchange or transfer points, using elevators and more recently escalators to shorten the time between lines, and to encourage passengers to make the long descent to ride the deep level tubes. The layout of lines, difference in clearances and varying equipment virtually preclude any extensive the idea of serving the long-haul riders. This is clearly more feasible than in America, because of the distance fare.

Together, the tramway lines operated by the Underground and those operated by the London County Council cover the entire city, with the exception of the central district included in the old City of London and a part of Westminster, an area about 2 miles by 6 miles in extent. The Underground tramways are mainly in the northwest quadrant of the city, while those of the London County Council are spread out through the other three quadrants, serving particularly the portion of the city south of the Thames. These two tramway systems in general are not competitive.

The outstanding difference between the London tramways and American street railways lies in their exclusion from this central area. This district comprises the main business, shopping, theater, church, and the sightseeing and governmental activities. Obviously, this exclusion, which dates back to horse-car days, is a tremendous handicap to the trams, especially now that bus operation is permitted in this inner area and covers it completely. The buses not only operate inside this territory but out into the other sections of the city in every direction, competing with both the company

Lord Ashfield on the Future of Tram and Bus

A RECOGNIZED authority on transportation in London is, of course, Lord Ashfield, managing director of the Underground Group of trams, buses and railways (subways). The committee naturally sought from him the policies being followed in the development of the several services and his views with respect to the future place of each system in London's general transportation scheme.

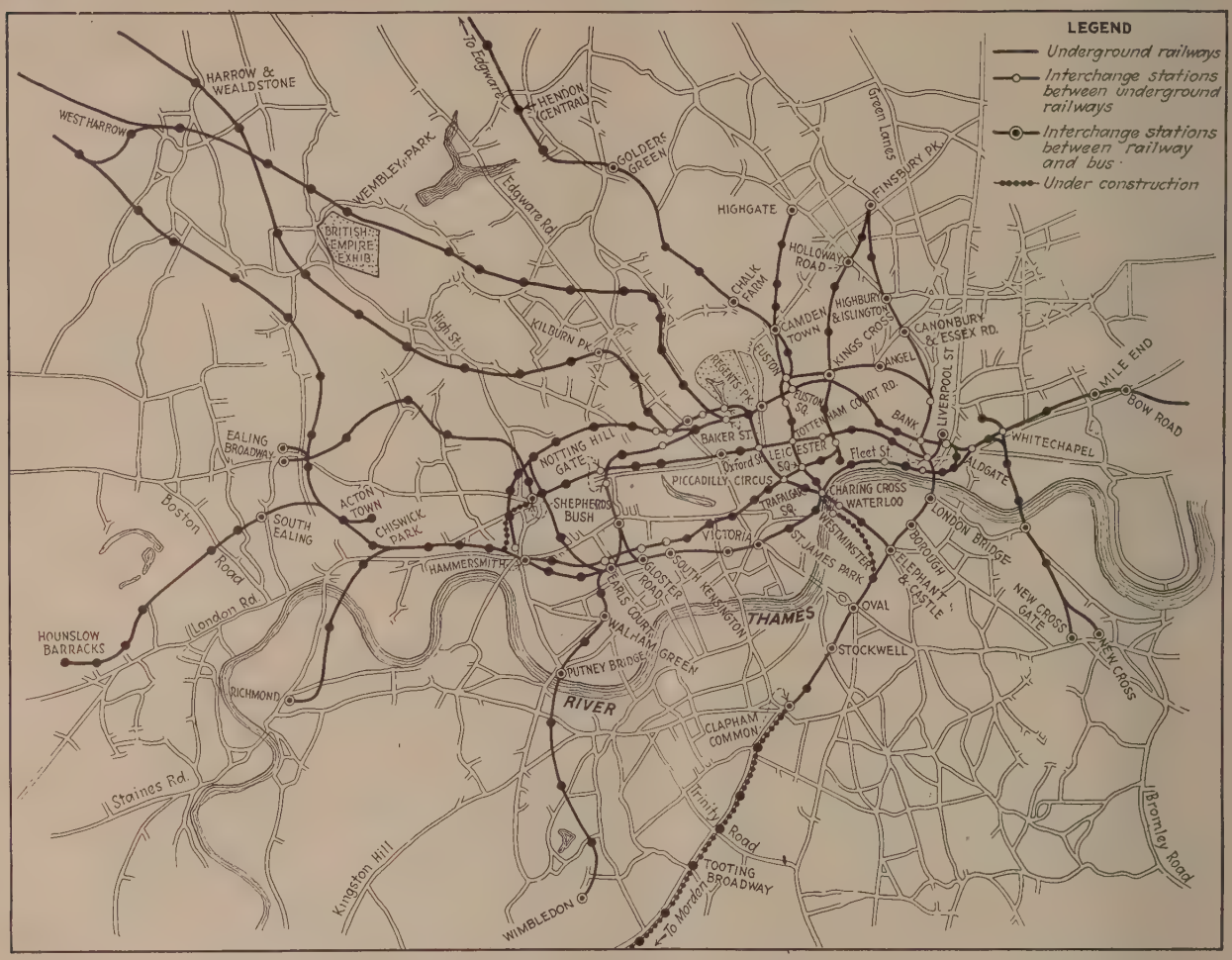
Map of the bus routes operated by the London General Omnibus Company, which virtually cover all London

owned and corporation* owned tramways, and with the underground and steam railroads. People naturally prefer to board the vehicle which will take them to their destination without change, rather than ride the tram or tube part way and then change to the bus, even though this no-change ride may require a slightly longer time.

Nevertheless, London is so spread out and is so uniformly built up to four or five stories that there is a tremendous source of traffic outside the central area from which the tramways can draw traffic.

Lord Ashfield does not feel that buses could carry all of the people now handled by tramways, as there is insufficient street space available. He thinks, however, that the ultimate plan will be to have only buses and rapid transit lines. Of course, he is speaking for London only. Meantime, the tramways should be used for the peak-load service primarily. And inasmuch as they are essential now in the rush hours, they can be operated in the off-peak hours too with comparatively small additional expense. He said that it would be very undesirable to supplant the tramways with buses now, as this would precipitate the immediate necessity

*Municipal.



Map of the London Underground lines, which indicates how the system is made up of numerous individual routes built independently without regard to the location of previously existing lines

to build extensive additions to the rapid transit system long before it would be possible to finance them and long before they are required.

Asked if all the passengers now handled by the tram, which number one billion a year, could be handled by buses, Lord Ashfield said that they could, in the event that sufficient street space, which is not now available, were provided. But the cost of widening streets would be prohibitive, he continued, so that the trams are necessary until such time as they can be replaced by underground railways.

With the growing use of the bus, this means that in some instances the tramways will have to be operated at a loss, and the only way that this can be done in the interest of the public service is that the several forms of transportation shall be under a single management with a pooling of results, so that, taken as a whole, the transportation service may be conducted as a successful business. The London General Omnibus Company and four of the companies comprised in the Underground railways are now operating under a common fund arrangement of this kind. There is also a working agreement between these companies and the tramway lines operated by the Underground people, although the tram-line earnings are not actually included in the common fund plan.

With these views about London transportation in mind, Lord Ashfield expressed himself to the effect that American operators are missing a great opportunity by not quickly making greater use of the bus in co-ordination with the railways, in order to place themselves in position to control the whole situation.

Lord Ashfield is of the opinion, as are all of his assistants, that the people of London prefer the bus to the tramway. None of them could explain why this is, but it is a fact that was perfectly evident to us from our observation in riding about the city on the various forms of transit. Some of the reasons advanced for this popularity of the bus were as follows:

JOURNEYS PER HEAD OF POPULATION IN GREATER LONDON

Year	Tubes and Tunnels	Trunk Lines (Estimated)	Total Railways	Omnibuses	Tramways	Gand Total
1909	56	39	95	51	96	242
1910	59	39	98	52	106	256
1911	59	39	98	55	113	266
1912	59	39	98	75	109	282
1913	60	38	98	100	110	308
1914	59	36	95	102	114	311
1915	61	38	99	91	113	303
1916	66	38	104	94	119	317
1917	78	42	120	88	123	331
1918	88	47	135	92	133	360
1919	94	51	145	116	142	403
1920	97	54	151	125	143	419
1921	82	47	129	125	135	389
19 2	79	46	125	143	138	396
1923	76	46	122	163	136	421

	1911	1921
Population Greater London	7,251,358	7,840,201
Population London County	4,521,685	4,484,523

1. The exclusion of trams from the central business district gives the bus what the tram officials call the "bus paradise." People must take the bus or the underground to get into or out of this central district, and as both buses and tubes continue on out into the suburbs in practically all directions, they naturally continue to ride on the vehicle first boarded. This in part explains why there are, in light traffic hours, more passengers on the buses than on the trams out where the two parallel each other on the same street.

2. The bus is a new form of transportation, while the tram is old and there have been almost no changes in its design in 30 years.

3. Buses come up to the curb, making boarding and alighting easier, especially in the congested areas.

4. The tramcar is primarily the workman's vehicle. Up to 8 a.m. he rides it at half fare by statutory provision included in the act of Parliament of 1870, under which all of the tramways of Great Britain still operate. Class distinction runs rather high in England, and many people will ride the bus who would not be seen on the tram.

5. For some reason the tram has always been unpopular. One reason assigned for this by Lord Ashfield was that in the early development stage tram lines were built in sections where they were unnecessary on narrow streets, and were thereafter somewhat of an obstruction to traffic and were disliked because of that.

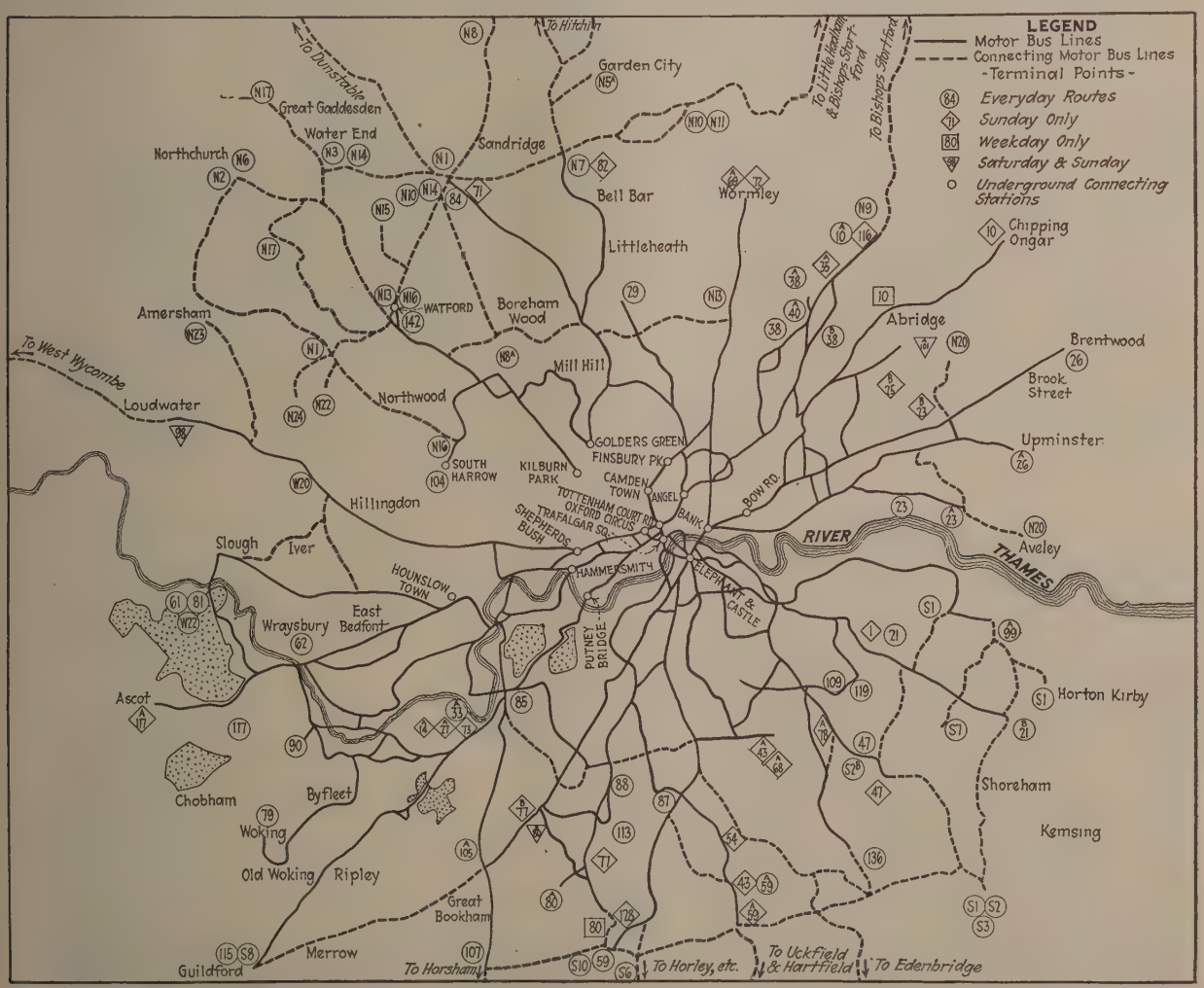
6. There is a popular impression that the bus is faster because it weaves in and out of traffic and passes other buses and sometimes trams. However, actually, there is little difference in its schedule speed.

7. A ride on the tram is rather prosaic, while the ride on a bus, dodging in and out of traffic, has in it some of the elements of adventure.

8. The open top on the bus has undoubtedly contributed to its popularity on fair weather days. However, considerable study is being given in London to closing in the upper deck so as to make the entire bus capacity available in bad weather. The principal difficulty in this connection is the rigid restriction on bus dimensions and weight imposed by Scotland Yards.

Asked what he thought about the desirability of using double-deck buses in America, Lord Ashfield said that he would not use anything else where the camber (crown) of the road and road conditions would permit, taking into account the high center of gravity of this type of bus.

We asked his Lordship whether he thought the zone-fare system should be applied in America. His answer was "no." He reasoned that transportation benefits everyone living or doing business in a community. It is impossible to say that it benefits the man who lives far out more than the one who lives close in, and there



Country bus routes operated out into the territory surrounding London by the London General Omnibus Company

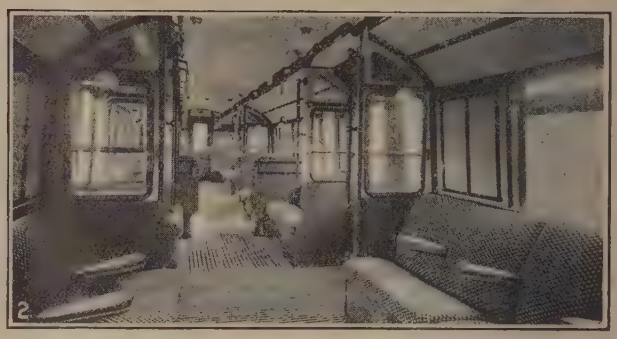
Selling Transportation on London Underground

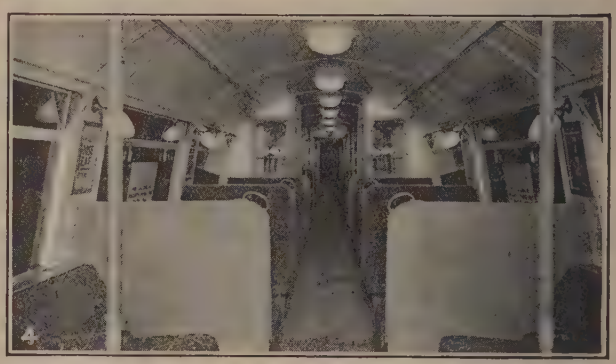
New motor car (1) and trailer (5) for one of the tube lines. Trains are made up with a motor car at each end of a six-car unit. Clearances do not permit motors on every car and the equipment on motor cars must be mounted in the cab, which occupies about one-third of the car. Note marker system on motor car dash, markers not in use being covered over with a lid which blocks off the lamp.

2. Attractive interior of the newer type London Underground tube trailer.

3. A typical example of the newer idea of making the underground cars inviting as worked out on cars for the tunnel lines, where clearances are not so limited.

4. Velour upholstering, a bright finish and shaded center lighting with a small shaded light over each seat back help to make these tube cars attractive.





is no reason why he should be penalized for the longer ride he must take. In fact, he ought to be encouraged because of the longer time he is forced to spend in getting back and forth.

This naturally raises the question of why the zone system prevails in London, then. The immediate answer is, as his Lordship said, that the English people have been brought up on a very low fare for a short distance ride and it would never be possible to establish a flat rate high enough to average out a sufficient total revenue. He made the reflection that it is possible to do almost anything on the start-off, but it is extremely difficult to change a practice once it becomes established. In this connection, he thought it might that traffic conditions in London would be intolerable if it was undertaken to handle all of the passengers in buses. Considering the relative merits of the bus and tram, he said that the main consideration must always be the financial one. As long as the tramcar has such a big advantage in seating accommodations, the cost per seat-mile for operation must always be considerably less for the tram than for that of the smaller vehicle.

In considering London traffic, it must not be forgotten that the tramcars are excluded from the profitable central London area, in which the proportion of short journey riders is very high, so that figures of earnings per car-mile for tramcars and those for omnibuses in London are not strictly relative. Expressing it another

The new Edgware extension of the London Underground

Part of this is in tubes and part on the surface or in open cut or fill. Note typical construction, rock ballast, wood ties, rails supported in chairs held by screw spikes, third and fourth power rails, cable bracket racks supported on concrete posts or side wall, the cast iron tube, with inside diameter of 11 ft. 8¼ in., and the low design of cars to conform to the tube clearance.

be desirable in America to establish the zone system on buses when beginning their operation. This would attract the short-haul rider.

The committee's opinion is that the fearful complications of the London zone ticket system would certainly be a deterring factor to an American operator. In fact, it was found that railway men in Great Britain generally would welcome a way to be released from the heavy expense and difficulty of handling and collecting fares which the zone system entails. For example, it makes one-man operation, which has been the salvation of many American street railways and which makes much of the prospective bus operation attractive, virtually impossible.

London's Municipal Tram System Operates No Buses

The London County Council Tramways does not operate any buses, as it is not empowered to do so—a matter of politics. Aubrey Llewellyn Coventry Fell, general manager, said in discussing the London bus situation, that there necessarily must be some overlapping of buses with the trams on account of the trams being excluded from the central area. However, in addition to the reasonable overlapping of service, there is considerable duplication. This is resulting in a substantial reduction this year in the amount of traffic handled by the London County Council trams. Mr. Fell feels way, he said that if the tramway system operated in the central London area, the revenue per car-mile would be increased, whereas there is no reason to think that the expenses per car-mile would be increased. Mr. Fell also made the general observation that in addition to the traffic taken from the tramways, the buses undoubtedly do create some traffic of their own.

Characteristics of British Operation

At the present time it can be said that London streets are virtually flooded with bus service. This has been brought about by the fact that the only means available to the London Underground Group to keep control of the transportation situation was to meet bus competition by putting so many buses on a route that the traffic available per bus would be diluted to the point that the individual bus operators would be discouraged. Carrying out this program, the London General Omnibus Company has added about 1,000 new buses to its services during the past year. Even with this determined effort of the L. G. O. to meet competition, there are still some 300 independently owned buses in operation. Any one can go into the bus business in London who provides himself with a bus whose design meets the rather rigid requirements of Scotland Yard. This is the only requirement.

This heavy increase in bus service has brought an enormous increase in the number of passengers carried

The new Hendon station, midway out on the Edgware extension of the London Underground, recently placed in operation

"Booking offices" and general interior view of the new Hendon central station on the Edgware extension of the London Underground

by the buses. Part of this increase has been in the nature of a newly created traffic, but a good deal of it has been taken from the tramways and the underground lines. Thus, the London Underground management is in the position of expanding its bus services at the expense of its own tram and tube lines, and at the expense of the municipal tram lines. It is even working against itself on its bus operations, for the excess of service in fighting competition has reduced the average earnings per bus-mile. The bus mileage operated by the London General Omnibus Company in 1922 was 94,124,000, and that in 1923 was 118,494,000, an increase of practically 26 per cent. For the corresponding calendar years, the number of passengers carried was 846,682,000 and 1,039,935,000, respectively, an increase of 23 per cent. The result has been a decrease of 3.62d. (7.2 cents) in gross revenue per bus-mile, while expenses were reduced 3.27d. (6.5 cents). Thus the margin of profit, after deducting all charges except those for capital, showed a decrease of 0.35d. (0.7 cent) per bus-mile. The actual revenue and expense figures are confidential and not available for publication.

The bus undertaking in London to date is understood to be a substantially profitable one. One thing that should be appreciated in this connection is that no attempt is made to provide bus equipment for handling the peak loads. Bus operation does not begin until about 8 o'clock in the morning, as the half-fare workman's rate, a statutory provision for the tramways, naturally brings them all of this early morning riding. The bus service continues for about 12 hours while the daytime riding is good, and then is very greatly curtailed about 8 o'clock in the evening. After that hour, virtually only those routes which serve the main traffic arteries are continued through the evening. These two things relieve the bus operation from the heavy capital carrying charges which accompany the handling of the peak loads, and from the loss from operation over routes and at hours which cannot be operated at a profit. With respect to other obligations, the tram and bus compare as follows:

The tramway regulations are statutory. They must run a reasonable service at a maximum fare of 1½d. per mile. They must pay taxes on the tram lines in

The new Hendon station on the Edgware extension

The station platform, showing bridge passageway from rear of station building, and the switchman's tower. The surroundings indicate the open character of the territory into which the new line extends, but construction of which has been accompanied by very large residential building activities.

Edgware station building and forecourt at the terminus, 11 miles or 35 minutes from Trafalgar Square, of a new extension of the London Underground opened for service on August 18

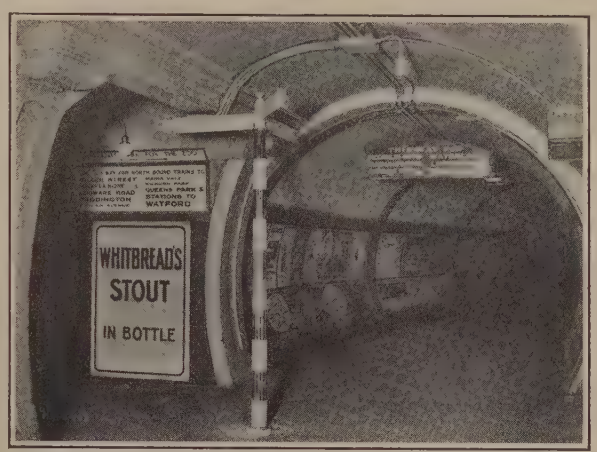
the streets as well as on all buildings. They are under the Ministry of Transport with respect to all kinds of regulations and by-laws and also are under the police with respect to licenses, quietness of operation, general condition of maintenance, and must be repainted each year. They must build and maintain the tramway paving for 16 ft. in the center of the road. Each private company is subject to purchase by the municipality 21 years after its beginning, not as a going concern, but for its then physical value. Thereafter it is subject to purchase at 7-year intervals, introducing an uncertainty which makes it impossible to finance any improvements, and impracticable to keep up repairs.

The Ministry of Transport determines the speed and size of cars (maximum speed allowed in London is 16 m.p.h. if cars are fitted with magnetic brakes). They are required to stop if hailed, and if off schedule they cannot pass up a passenger without being liable to a fine. In most cases the tramway must pay a franchise tax.

Omnibuses, on the other hand, have no statutory obligation to the public. They can charge any fare and run any service they may choose. They pay no rates (real property taxes) except on buildings. They maintain no roads directly except by the tax which is based on seating capacity (what we usually call the license tax). They are under the police in the same way as tramcars with regard to licenses and speed of operation, and weight and size are similarly limited.

The buses also escape the burdens which fall upon the tramway with the numerous road-widening projects which are under way throughout Great Britain. The London Underground Group tramways, for example, carry now a cost in capital of about £20,000 ($97,400) per mile of track which has no asset value, and which represents what they have had to contribute to civic improvements that have added nothing to the physical value of the tramways.

Those closely allied with the operation of the tramways in London now feel that either the tramways must be given some measure of relief from their obligations or that the omnibuses must be made to carry more nearly commensurate obligations. Recently a bill has been passed by Parliament which is a step in the latter direction, and which will tend to do away with the flooding of streets with bus traffic to fight competion. The measure will probably be of little help to the tramways, except indirectly as they may benefit from a more normal bus service. About all that this bill does is to provide the Ministry of Transport with authority to regulate the amount of omnibus traffic on any street.



Typical signs in the Oxford Circus station of the Underground, London. They enable patrons to direct themselves through the system of passageways, which are most intricate, especially at the junctions between lines

Stop sign adopted by the London General Omnibus Company, which not only locates stopping points but indicates the route numbers of buses which stop there

Paris Transportation Facilities

PARIS, like London, also has extensive tram, underground and bus services. There is a greater degree of co-ordination there, as all of the surface transportation facilities are under one management. There is necessarily some paralleling of bus and tram lines on the same streets, but taking the whole route of each into account, the two lines serve different localities and a different traffic.

The Paris situation is similar to the one in London in another respect, namely, that there are no tramway lines in a considerable area of the central business district. Buses serve this territory thoroughly and derive a heavy short-haul traffic, for which the tramway does not have the same opportunity.

The extent of the tramway system is measured by the fact that there are 1,875 motor cars and 750 trailers, total 2,625, operating approximately 60,000,000 car-miles per year and carrying 700,000,000 passengers per year. The bus system comprises 1,250 four-wheel buses and 50 six-wheel buses, total 1,300, which operate 29,000,000 bus-miles per year and carry annually 336,000,000 passengers. In contrast with London, all of the buses are single deck, and the great majority of tramcars also.

The Paris underground system, which is under separate management, comprises approximately 100 km. (62 miles) of double-track route. Like the surface transportation systems, the underground system is municipally owned, but privately operated. Some 1,700 cars are operated on the underground lines with 57,377,654 car-miles and 500,000,000 passengers annually. The accompanying Paris maps show the relation of the bus, tram and underground systems.

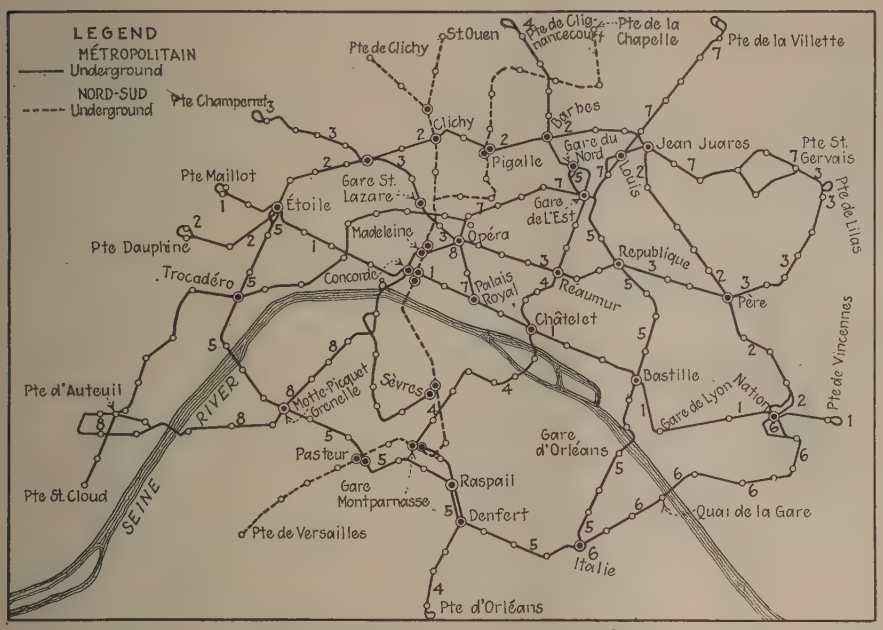
Unfortunately, the committee was unable to learn the views of the railway officials as to the relative place of bus and tramway in the future Paris transportation needs, as nearly all of the principal officials were away on holiday. It would seem to be the case, however, that the development of the tramway is being carried forward as well as that of the bus, inasmuch as a considerable number of new tramcars of a new design are being built, as noted in another section of this report.

American Bus Policy Confirmed

To sum up the European policy with respect to the bus, the committee has found that the views and practices prevalent there as to the place of the bus are in direct confirmation of the leading thought of the industry in the United States. That is to say, there is a large field for the bus and it should be used as one of the modern tools of transportion. It should be coordinated with existing rail lines rather than operated competitively. The best results from operation of buses will be derived if they are under the same management as the railway. The local railway company is the one properly organized and equipped to operate buses in conjunction with the other services.

The consensus of opinion of the European tramway

Paris tramway and bus lines operated by the Société des Transports en Commun de la Région Parisienne



Underground Railway System of Paris

managers is that the bus has not the capacity to replace the tramway in providing the main transportation service in any sizable city.

European Street Congestion Notably Lighter

GENERALLY speaking, there is no street congestion in Europe that is comparable with the conditions prevailing in the United States. The major reason for this is that the number of private automobiles in use here is five or six times as many as in Great Britain, and the ratio would be even larger in comparison with the Continental cities. For example, the total number of motor vehicles of all classes registered in Great Britain on Feb. 29, 1924, was 936,662, which compares roughly with the total motor vehicle registration in the United States for 1923 of 15,092,177. The corresponding number of inhabitants per motor vehicle is 7.3 in the United States and 43 in Great Britain.

There is rather heavy street congestion at some points in the central business district in London, but this is caused almost entirely by the motor buses and taxicabs, and these two classes of traffic comprise as a rough estimate probably 90 per cent of the total vehicles on the street. The heaviest points of congestion are at such centers as Trafalgar Square, Piccadilly Circus, Oxford Circus, the Bank, Elephant and Castle, etc., where a number of streets converge into a circular traffic center. London's street layout is a maze of crooked routes with numerous centers from which streets radiate in all directions and with these radiating arteries crossing each other at all sorts of angles and without system. The only American city which compares with this at all is the older part of Boston.

Obviously, under this scheme, there is almost a total absence of parallel routes in any one general direction, this tending to bring about congestion where the travel in one direction is heavy. With the future expansion in the use of private automobiles, now showing an increasing rate of growth in Great Britain, the operation of buses, which now have nearly the whole street, will become more and more difficult. Even now, the average speed made, for example, on Oxford Street, Fleet Street and the Strand, and through the centers named above, is only 3 to 4 m.p.h. Some of the pictures taken by the committee on week-day afternoons show how completely the buses occupy the streets. (See pages 416, 436). It should be noted also that no parking is permitted, except that taxicabs may stand in a single line in the centers of some streets at certain points.

Another important factor which, in comparison with American cities, tends to make for less severe street congestion in London is that the building heights are limited by public authority and are uniformly from six to eight stories in height. There is consequently no such concentration of people during business hours as we have in our principal American cities, and the problem of all of the transportation systems is correspondingly less severe at any one point. In other words, the loading and discharging of passengers is spread out over a considerable area. This distribution of business is also an important contributing factor in the high proportion of short-haul riding which the transportation companies enjoy, especially in the off-peak hours. It tends, too, to give a better all-day load factor. The buses, of course, benefit primarily from this short business riding, as they are exclusively in the business area. But this situation in the business area, as well as the solidly built-up nature of all London, and short-haul fares are responsible for the high number of passengers per car-mile carried by both buses and trains. The average number of passengers per car-mile on the tramways in London is 10.5 and on the buses 8.75. These compare with about 7 passengers per car-mile average in the United States.

Regulation of the flow of traffic in London streets is of the simplest kind and yet seems to be very effective. No mechanical signals of any kind are used and the number of traffic officers seems to be remarkably small. The governing principle is to allow traffic to weave in and out and take care of itself to a large extent and to permit traffic officers to handle the movement as the conditions of the moment dictate. The result is that traffic is handled with little apparent evidence of the control. In fact, this traffic regulation was the best example the committee observed of the "effortless efficiency" on which London business prides itself.

While the handling of vehicular traffic in London is effective (and much the same description would apply to Paris), not so much can be said for the protection and assistance given to pedestrians. Safety islands are provided to a certain extent, and at a number of heavy loading points the tramways have permanent loading platforms which are of great assistance to the pedestrians. But by and large the pedestrian must look out for himself. And with the confusion of traffic lanes due to the converging and diverging streets at the circles, the crossing of streets on foot is somewhat of an ad-

London Traffic a River of Buses

Street traffic scenes in the central district of London, showing the severe congestion. Owing to the very small number of private automobiles, as compared with the number in the United States, the buses have nearly the whole street to themselves and in many places practically fill it, as seen in these pictures, taken on a week-day afternoon between the hours of 3 and 5. Above and at right, views on Oxford Street, one of the shopping centers. Below, Trafalgar Square looking down the Strand. At the moment this picture was taken there was not so much evidence of congestion, yet 17 omnibuses are visible.

venture. Probably it should be said that in London the members of the committee noted this particularly because of unfamiliarity with left-hand operation.

Two factors which contribute to the difficulty of the pedestrian are that vehicles are not required to stop behind a street car while it is loading or unloading passengers, and that buses are continually passing each other while going in the same direction. This ability of one bus to pass another, which is one of its great advantages, contributes to the accident hazard and the difficulties of the pedestrian. Bus accidents of all classes increased in London for the year 1923, as compared with 1922, from 13.9 per 100,000 bus-miles to 19.4. This, of course, was due in part to the large addition to the number of buses operated, the corresponding increase in new and inexperienced drivers, and to a certain extent to the keen competition with the "pirate" buses.

Track Construction Differs from Practice Here

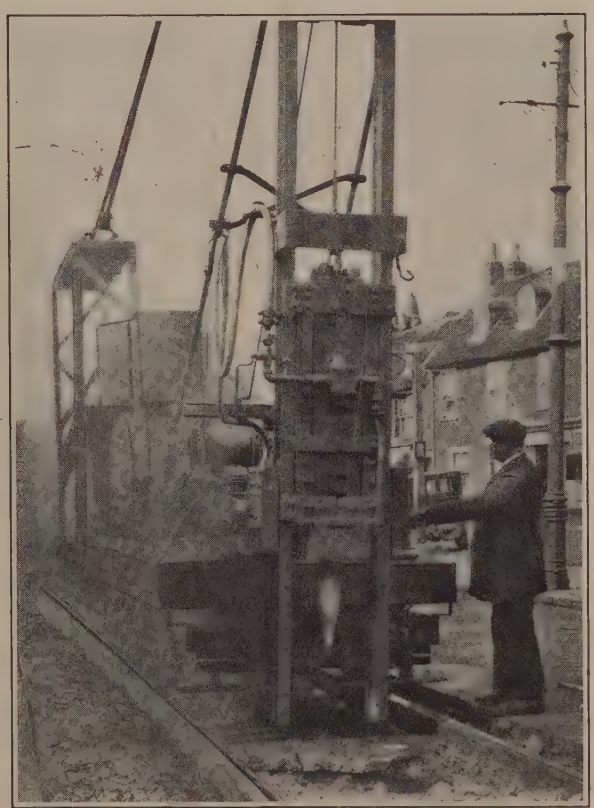
Particular Features Are the Absence of Cross Ties in Concreted Track, the Method of Sealing the Rail Against Moisture, and the Pressure System of Thermit Welding Joints

THE outstanding thing to an American railway man about the track construction of British tramways is that the track there is built virtually without sleepers (cross ties), or with the spacing between cross ties so great that they act merely as anchors. In paved trackwork a concrete base is used almost entirely in the newer track construction. The rails are laid practically direct upon the concrete. They are maintained at gage in some instances by means of sections of old rail spaced 7 ft. 6 in. apart, and imbedded in the concrete, and in some cases also by means of tie rods with the same spacing. Usually, some special means is used for bringing the base of the rail into full contact with the concrete. For example, on the London Underground tramway lines, a ½-in. to 1-in. space underneath the rail base is packed with granite chips and then floated with tar or bitumen. This acts as a seal to keep water out from under the rail base.

On the London County Council tramway tracks, the rail is fastened to the old rail anchors by means of clips with a ⅝-in. hardwood packing block between the rail base and sleeper. But the concrete is poured so that it comes in direct contact with the base of the rail between sleepers. A 1-in. cement and sand bedding (dry grout) is laid over the surface of the concrete to form a base for the paving sets (granite block), which are sealed between blocks and around the rail by granite chippings and bitumen.

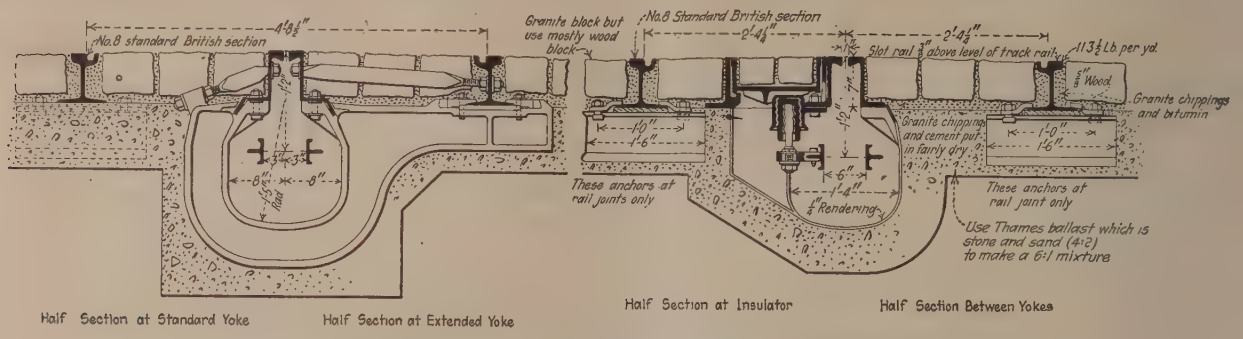
The packing around the base of the rail which is placed underneath the base and carried up over the base of the rail, as used by the tramways of the London Underground Group, consists of a pitch packing of medium pitch and creosote oil tempered so as to be quite pliable. A small quantity of hot fine sand is added before the mixture is poured. The filler is then allowed to set at least 12 hours.

In Edinburgh the concrete foundation is left 1 in. clear from the base of the rail, and this space is then securely packed with a dry packing made up as follows: One part of ¼-in. granite chips and one part of sand to one of cement. The packing is hammered gently but firmly under the rail, men working on either side of the base. The "causeway setts" (granite blocks) are laid on a dry concrete bed 2 in. thick which is made up of two parts of ½-in. granite chips and two parts of sand to one of cement. No beater is used, the pavers laying the sets to the required level. A tar waterproofing coat ¾ in. thick is then poured between the setts to protect the dry concrete paving bed from being washed away by rain or affected by the weather. When the tar has dried thoroughly, a wet concrete grout, of the proportions two parts ¼-in. granite chips and one part sand to one of cement, is well brushed between the setts to the level of the road and allowed to set for one night. This grout settles in drying and on the following day a cement grout of the same proportion, but not quite



Pneumatic pile driver used by the London Underground Group Tramways for breaking up concrete

The steel point is lowered in contact with the concrete and the air hammer then put in operation, driving the steel point through the concrete and breaking it up. This was claimed to cause much less damage to underground water and gas mains and to surrounding buildings than was formerly experienced with the more usual method of dropping a heavy weight.


No.8 standard British section
Granite block but use mostly wood block
No.8 Standard British section
Slot rail ⅞" above level of track rail
113½ Lb. per yd.
⅝" Wood
Granite chippings and bitumin
Granite chipping and cement put in fairly dry
These anchors at rail joints only
⅝" Rendering
These anchors at rail joint only
Use Thames ballast which is stone and sand (4:2) to make a 6:1 mixture
Half Section at Standard Yoke
Half Section at Extended Yoke
Half Section at Insulator
Half Section Between Yokes

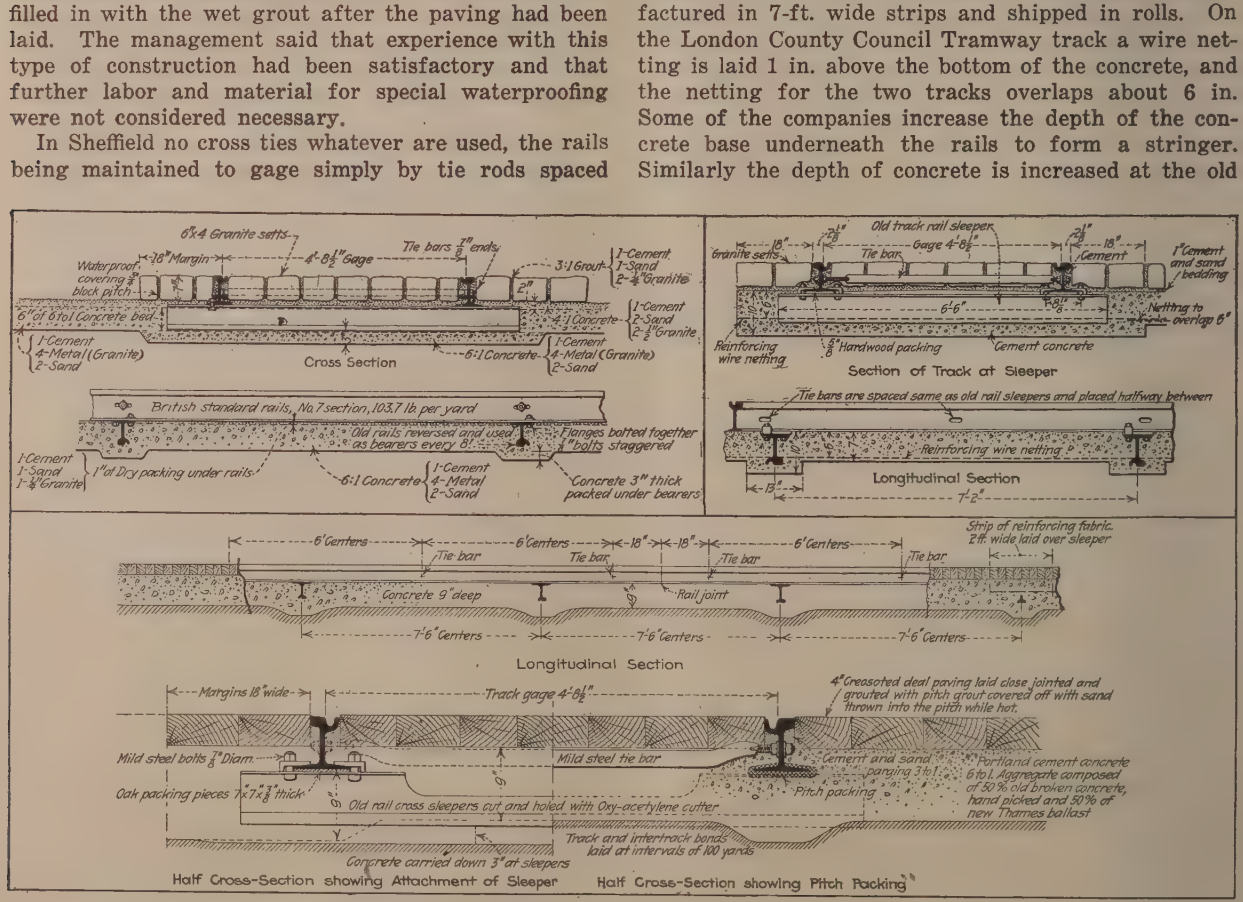
Four sections of the conduit track construction used on part of the lines of the London County Council Tramways. The extended yokes are placed on 7-ft. 6-in. centers with short yokes half way between

so wet, is lightly brushed over the road and left about ⅛ in. above the sets. No traffic is allowed on construction of this type for a period of from four days in dry weather to eight days in damp or wet weather. The Edinburgh engineers have found that should it be desired to open up a section of road for cross traffic at any point, the tar waterproof covering may be increased to a depth of 2 in., and the final coat of wet concrete grout covered with granite chips. This has been found to be very effective and shows no bad results even though the road is used within 36 hours.

In Birmingham the rail is laid directly on the concrete with no special care for waterproofing. The space between paving blocks and that around the rail is simply filled in with the wet grout after the paving had been laid. The management said that experience with this type of construction had been satisfactory and that further labor and material for special waterproofing were not considered necessary.

In Sheffield no cross ties whatever are used, the rails being maintained to gage simply by tie rods spaced 6 ft. apart. The rails are anchored to the concrete by means of bolts placed when the concrete is poured. Dry granite chips with tar pitch is the material used between rail base and concrete.

The thickness of concrete base used varies from 6 in. to 9 in. underneath the base of the running rail on the various English properties. Some of the tramway companies use reinforcing mesh to give the structure greater strength. For example, the Metropolitan Electric Tramways, London (part of the Underground group), places a reinforcing fabric 2 in. above the bottom of the concrete. This is composed of ¼ in. diameter mild steel rod, made with a 6-in. square mesh and the rod electrically welded at the intersections. This mesh is manufactured in 7-ft. wide strips and shipped in rolls. On the London County Council Tramway track a wire netting is laid 1 in. above the bottom of the concrete, and the netting for the two tracks overlaps about 6 in. Some of the companies increase the depth of the concrete base underneath the rails to form a stringer. Similarly the depth of concrete is increased at the old


6"x4 Granite setts
Waterproof covering ⅜" block pitch
18" Margin
4'-8½" Gage
Tie bars ⅞" ends
3:1 Grout
1-Cement 1-Sand 2-⅜" Granite
6" of 6 to 1 Concrete bed
4:1 Concrete
1-Cement 2-Sand 2-⅜" Granite
1-Cement 4-Metal (Granite) 2-Sand
Cross Section
6:1 Concrete
1-Cement 4-Metal (Granite) 2-Sand
British standard rails, No.7 section, 103.7 lb per yard
Old rails reversed and used as bearers every 6'
Flanges bolted together ⅞" bolts staggered
1" of Dry packing under rails
1-Cement 1-Sand 1-⅜" Granite
6:1 Concrete
1-Cement 4-Metal 2-Sand
Concrete 3" thick packed under bearers
Old track rail sleeper
Granite setts
Tie bar
Gage 4'-8½"
1" Cement
1" Cement and sand bedding
6'6"
Netting to overlap 6"
Reinforcing wire netting
⅜" Hardwood packing
Cement concrete
Section of Track at Sleeper
Tie bars are spaced same as old rail sleepers and placed halfway between
Reinforcing wire netting
Longitudinal Section
7'2"
Strip of reinforcing fabric. 2 ft. wide laid over sleeper
6' Centers
Tie bar
Concrete 9" deep
Rail joint
7'6" Centers
Longitudinal Section
Margins 18" wide
Track gage 4'-8½"
4" Creosoted deal paving laid close jointed and grouted with pitch grout covered off with sand thrown into the pitch while hot.
Mild steel bolts ⅞" Diam.
Mild steel tie bar
Cement and sand panging 3 to 1
Portland cement concrete 6 to 1, Aggregate composed of 50% old broken concrete, hand picked and 50% of new Thames ballast
Oak packing pieces 7"x7"x3" thick
Pitch packing
Old rail cross sleepers cut and holed with Oxy-acetylene cutter
Track and intertrack bonds laid at intervals of 100 yards
Concrete carried down 3" at sleepers
Half Cross-Section showing Attachment of Sleeper
Half Cross-Section showing Pitch Packing

Typical British Tramway track construction

Sections of track construction employed by Edinburgh Corporation Tramways, upper left; by the London County Council Tramways, upper right; and by the London Underground Group tramways, below

rail anchors, usually to a depth of about 10 in. below the rail base, where such anchors are used.

The rail used in paved streets by the English and Scottish tramways is all of the standard English section, girder grooved, weighing from 103 to 113.5 lb. per yard. The height of this rail is usually 7 in. and it comes in 45-ft. lengths.

All Rail Joints of Electric and Thermit Welded Types

Rail joints are almost entirely of the thermit and electrically welded type, with the thermit predominating. The Sheffield Corporation Tramways are using plain fishplates, 14 in. long, with the outside edges slightly grooved out to make space for the welding rod material. The simplest form of arc welding is done, using the trolley current direct, and the engineers reported that they have not had a single joint breakdown in the two-year period in which this type of joint has been employed. A rather unique feature here is that a simple pin-type bond is placed around each joint. No bolts are used with these joint plates. In general, it may be said that the British tramways have had less experience with the electrically welded joints than we have had in America.

The thermit type of welded joint seems to be much more extensively used in Great Britain than it is in the United States, and with almost universal satisfaction. The Metropolitan Electric Tramways, London, reports that many miles of track have been welded this way during the last five years, and these joints have given a practically perfect account of themselves. This work is all done by "jointers" trained and supplied by the Thermit Company. The railway simply contracts with the Thermit Company for so many joints, the latter supplying the jointers and the railway supplying the rough labor. On this basis, the total cost per joint to the tramway averages about £2 to £2.5 per joint, inclusive of the hand filing method of finishing the surface of the rail, which to Americans seems a rather expensive method of finishing. However, the English engineer considers that there is not the same danger of cupping with a hand file that exists with any rotary machine, and as a pair of men can do about eight joints a day, they seem to be satisfied with this method.

The method of making the thermit joint in Great Britain is somewhat different from that commonly employed in America, and it is possible that this may account for its more nearly complete success. The point of difference is primarily the use of a screw clamp by means of which pressure is applied to the rail ends during the fluxing of the metals. The details of the process are as follows:

"Wattle hurdles" made of willows with straw woven in between

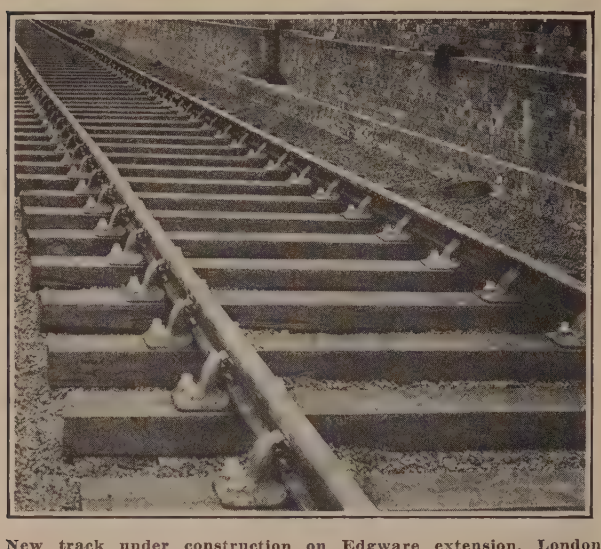
They are laid on the rails after the concrete is poured by the London Underground Group tramways. They keep the sun off the concrete and permit a circulation of air, causing the concrete to set much more quickly. It was also claimed to assist the setting in wet weather as it provides some protection from the rain.

The rail ends are brightened by a ratchet device and (where high carbon rails are used) a copper shim is slipped in between the rail ends. The screw clamp, which is shown in an accompanying illustration, is then drawn up so that the rail ends are tight together. A portion of the thermit material is then poured, and after a short space of time, about 2 minutes, the powerful screws of the clamp are drawn up with long levers so that several tons pressure is put upon the joint. The result is that the rail ends are welded into a homogeneous mass and about ⅛ in. of each rail is pressed into the weld. The engineers of the Metropolitan Electric Tramways report that before this pressure process of making the thermit joints was adopted the joints were very inferior.

Having American track construction practices in mind, the absence of cross ties and the comparative lightness of the British construction was of particular interest. How it is possible to gain satisfactory results with this construction may perhaps be explained by the

Track construction practices employed by London Underground Tramways

Left, screw clamp used to produce pressure between the ends of the rails during thermit welding. Right, chipped granite and pitch packing under and around the rail base. The tie rods are offset downward so as to interfere as little as possible with the wood block paving. Thermit joints may also be seen between the first two tie rods.



New track under construction on Edgware extension, London Underground, showing particularly the spring steel wedge now being used with the rail chair construction instead of the wood wedge

fact that in general the cars are lighter and the speeds lower than in America. The car weights vary from 20,000 lb. for the new single-truck double-deck cars in Edinburgh to 35,000 lb. for the two-motor double-truck double-deck cars in London. The average system speeds vary from 7 to 9 m.p.h. The maximum speeds are not high, as they are limited by restrictions set in each city by Parliament. In all our observations, it was exceedingly rare to see a car running at a speed as high as 20 m.p.h., though on the outer end of some of the lines of the London County Council Tramways speeds approaching 25 m.p.h. were observed.

Except in one or two cases, the "permanent way" in every city visited was in a noticeably good state of repair. In fact, it seemed to be the general feeling on the part of each management that to keep the track and paving in first-class condition was a matter of primary obligation. A broken-down joint, noisy special trackwork, or holes in the pavement were not seen anywhere over the systems, except in two cities. All of the managers made comments in one connection or another about the very heavy expense to which they were put in maintaining the permanent way.

In connection with the street widening programs which are being carried out on an extensive scale in many of the cities of England and Scotland as a means of making employment, the corporation tramways are frequently provided with a virtually private right-of-way in a park area through the center of the street. This entitles the tramway to make use of an open type of track construction, though it seems to be customary to bring the level of the ballast up to the top of the rails and in some cases to seed the area completely to give an unbroken lawn in the parkway. In all such cases, the ordinary type of open track construction employing wooden ties and rock ballast is employed.

One railway man in England makes good use of the vanity of women. He places a mirror on the rear body corner post. When about to leave the car women passengers take a fleeting look at themselves and hence are facing forward as they alight.

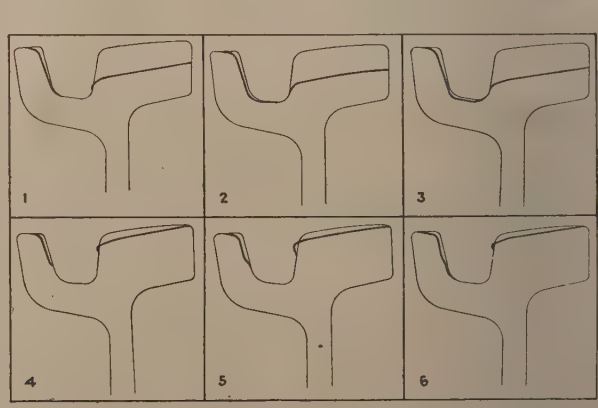
In Situ Treatment of Rails

THE British tramways have had more experience with the Sandberg *in situ* process of hardening the rail treads than we have had in America, but it may nevertheless be said that this experience is not yet of a sufficient amount to provide any definite opinion as to its merits. A number of the tramways have some of this rail installed for experimental purposes. The process is expensive, costing about as much as the original cost of the rail, and the best that can be said for it up to date is that the results have been sufficiently good so that some of the tramways are making further installations as a means of gathering further data.

The tramways of the Underground Group had several sample lengths of track dealt with in this manner a few years ago, partly with a view of seeing whether the claim of increased life was borne out in practice, and further, whether it eliminated or delayed the formation of corrugations. The result thus far is summarized by the engineers of these companies as follows:

In the first place, they say that there is no doubt that the initial stage of wear on the rail is reduced from a rate of about $\frac{1}{32}$ in. per annum to about $\frac{1}{64}$ in. per annum. This means that on the initial life of the hardening there is a saving of 50 per cent in the wear, but as the hardening apparently cannot be as good as it goes down into the rail, it is impossible to say how the wear will be affected after a few years of life. These engineers, however, make the statement that corrugations did not reappear on the short lengths of track where the process was tried. To further the study, these companies had treated some 4 miles of additional rail about two years ago, but naturally it will not be possible to come to any tangible conclusions for about five years. The principal interest in the process seems to be in the possibility that it may check corrugation. The engineers feel that unless this is accomplished, the process will have little value.

The London County Council Tramways in 1920 made a number of experiments with this process on test lengths chosen on routes with different traffic conditions. These tests were made on double track, one track being treated and the adjacent one left untreated for comparison. The result here has been that no prolongation of the life of the rails has been obtained anywhere



Wear of Rail on Metropolitan Electric Tramways, London

These rails were laid in October, 1919, on a route where the service is about 800 cars per day. They are steam treated Sandberg silicon sorbitic steel rails. The wear recorded was taken at six different points, sections 1, 2 and 3 being at main stopping points and 4, 5 and 6 at points between stopping places. These profiles show the serious wear caused by magnetic rail braking and also the conical wear of the British rail section which is the cause of much concern to all the tramways.

Swivel harps used on British tramways

The illustration shows how the swivel harp simplifies the operation of cars over the right-hand track (left-hand operation) when the left track is under construction. The same position of trolley pole off to one side may commonly be seen where both overhead wires are supported on one bracket from a pole line along one side of the street.

where the magnetic brake is used, but it has been successful in preventing the formation of corrugations.

One of the experimental sections of track treated was on Victoria Embankment between Waterloo and Hungerford bridges, the length being about 300 yd. of single track on a flat curve which carries about 810,000 cars per annum. This stretch of track was selected because of the repeated corrugation of the rails despite their continual removal by scrubbing (grinding). Before the treatment was applied, all the rail was scrubbed clear of all traces of corrugation and alternate lengths of rail were treated and left untreated.

Soon after the completion of the treatment in July, 1920, corrugation appeared on the untreated rail and developed to such an extent as to necessitate grinding in November, 1921. On the other hand, no corrugation appeared on the treated rail and no grinding was done. This test length of track was relaid in January, 1924, and up to that time no corrugations had appeared, though the untreated rail had been repeatedly scrubbed. As a further test, the new rails on this stretch of track were treated in April of this year. At this time all the rails on the down track were treated and those on the up track left untreated.

A rather neat station on the tube lines is made by use of a larger diameter tube

In applying the Sandberg process to the rails, it was necessary for the tramway to allow the contractor at least 4½ hours of uninterrupted operation after cessation of car traffic.

Overhead Construction

THE principal difference noted between European overhead construction and that employed in America is that no effort is made to center the wire over the track. Practically all of the tramways use a swivel-type harp which makes possible the successful operation of the trolley wheel or trolley shoe over a wide latitude of trolley position. Frequently, the trolleys for both tracks are supported on brackets attached to poles along one side of the street. The trolley pole of the car on the far track then takes a position of considerable angle with the center line of the car. The swiveled harp also has the advantage, in connection with new track construction where it is necessary to operate the cars in both directions over one track, that no attention need be paid to shifting the trolley wheel to the opposite wire when the car takes the other track. The wheel continues on its own wire and takes care of itself. However, the use of the swivel harp tends to increase the wire and wheel wear and it is also more expensive to maintain than the ordinary harp. Several tramway men expressed themselves as desiring to get away from the use of the swivel harp if it were possible.

Oil buffer used by London Underground Railways

This is placed on stub end tracks and also extensively used by the British steam railroads. While a car hitting this buffer receives an initial jolt, the plunger travels against the oil pressure sufficiently to avoid damage to the car, it was said, even though the speed at moment of striking may be 10 or 12 m.p.h.

In Berne, Switzerland, all of the tramway cars are equipped with bow collectors, which work very satisfactorily and require virtually no attention on the part of the conductors. Even at the ends of lines, where the car reverses direction, the bow collector takes care of itself if the conductor forgets it, though he usually pulls it over in the trailing position, while the car is standing. This is easily done, as the bow collector rides comparatively close to the vertical position. The use of the bow collector greatly simplifies the overhead construction, eliminating switches and frogs and also entirely eliminating dewirements.

One Swiss railway official who is quite familiar with practices in the United States and has connection with various systems in Switzerland said that he did not see why the bow trolley was not used in the United States.

On the properties with which he is connected, all wheels and trolley poles are being replaced with bow collectors.

Much of the trolley wire used now in England and Scotland is a 5 per cent cadmium alloy which is said to be giving a much longer life than ordinary hard-drawn copper.

Tramcar Design as Dealt with in Europe

Meager Development of the Tramcar Has Taken Place in Great Britain—Double Deck, Single Truck and Two Motors Continue as Standard Characteristics—But the Paris Tram Officials Have a Program of Building 400 Cars Which Depart in Mechanical Design from All Previous Practice —Main Features of This New Car Are Given

TRAMCAR design in Great Britain is pretty thoroughly standardized. The type most commonly used is a single-truck, double-end, double-deck car with both entrance and exit for upper and lower deck at the rear. In a few cities, double trucks or "bogies" are used, but in any event all cars are equipped with but two motors. The universal use of the double deck over there, while no double-deck cars are used in America, naturally gives rise to the query as to the reasons for this. The committee undertook to find out what these reasons were. While the double deck perhaps provides the lowest-investment means of supplying large rush-hour capacity, the main reason given everywhere for the use of the double deck was that it had always been used. Before there were any tramways, the old horse-drawn omnibuses were of double-deck design. The horse-drawn rail car was also of double-deck design. And when electrification came, the double-deck design continued. The only change that has come along is that in most of the cities the upper deck has been covered in.

The double-deck design does provide a very high seating capacity with low weight of car. On the London County Council Tramways, for example, the seating capacity is 78 and the weight approximately 35,000 lb. These cars are equipped with double trucks and are about the largest in Great Britain, with the exception of a few cars in Manchester which seat 82. The standing capacity in London is limited to 11 passengers on the lower deck, making the total carrying capacity 89. The company tries to have its conductors carry out the police restriction as to standing passengers, but it often happens that a car will carry 100 passengers.

The most modern design of tramway car is to be found in Edinburgh, where the cable lines have been electrified within the last two years. The new cars here are of double-deck design, but with the stairways arranged so that it is possible to use the front stairway for exit purposes, thus tending to reduce the congestion at the rear platform and speed up the loading and unloading. These cars seat 60, are equipped with single truck, with two 42-hp. motors. They weigh 22,400 lb. The stairway and vestibule arrangement in these cars, permitting front end exit, is indicative of a tendency in Great Britain since the competition of other forms of transportation has been causing the managers to give more attention to means of increasing the speed.

The platforms of the Edingburgh cars are long enough so that there is space at the side of the vestibule for a door underneath the stairway. One of the London tramway companies has built one car as an experiment with a stairway which can be revolved about a vertical axis, so that it may be used in one position at the rear of the car and in the opposite position at the front end to deliver passengers on the proper side of the car.

Of course, the new Edinburgh cars, like all the tramcars of Great Britain, are of the simplest possible construction and equipment. The body construction is almost entirely of wood, the seats are of the lightest wood slat type, only single floors are used, the sides are light panels without any insulation for heat or cold, the cars have no heating equipment, etc. In most of the cars there are no window sash as the glass is fixed, there are no curtains and no ventilating equipment (small sash above the side windows simply tilt in about 30 to 45 deg. to provide ventilation), there are no air brakes nor platform doors, and no safety devices. In fact, the committee was especially impressed with the fact that the tramcars of Great Britain in all the cities visited are totally lacking in the modern devices and equipment which contribute toward the convenience, comfort and safety of the passengers, but which in America add to the expense of maintaining the cars. The majority of the tramway corporations are building their cars today, in every detail, to practically the identical design that was employed 20 and 25 years ago. About the only important improvement in the tramcar that is in evidence is the replacement of the 20 and 30-year old motors with modern motors of better horsepower and of the ventilated type. These will provide higher acceleration and faster running speeds. Also, two or three companies have a trial installation of pneumatically operated platform doors, though there is virtually no use of even manually operated platform doors. Most of the tramways seem to be quite well satisfied with the single truck, despite the fact that all are greatly troubled with jazzing (nosing) of the cars, which tends to keep the speed down. The London County Council and the Birmingham corporations are rather the exception in their gradual change-over to two-bogie trucks. The main reasons given for retaining the single truck are that it costs less to maintain and rides just as well. The committee could not concur in this last claim.

The committee feels that this point should be made. Whatever may be the fate of the British tramcar, it cannot be said that it has been developed to its maximum possibility.

MAINTENANCE STANDARDS ARE HIGH

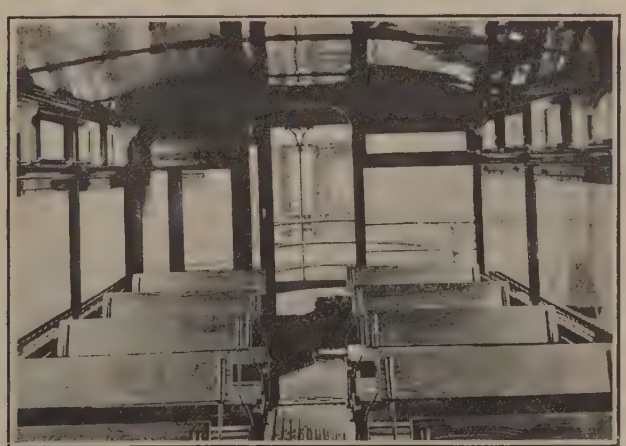
While British tramcar design does not interest an American railway man particularly, the latter has something to learn from his British brother in the way of

keeping the cars well maintained, well painted, clean and attractive, particularly on the exterior. The cars are tight and comparatively quiet; there is no rattling of loose parts on trucks or bodies. On an average with the various properties, the cars are completely dismantled and thoroughly overhauled about once a year, including a new coat of varnish and such touching up of the paint as is needed. This frequent attention to the varnish and the very general practice of washing every car nightly account for the uniformly good appearance of the rolling stock. In general, the expenditures made for cleaning cars amount to one-third as much, or more, as the expenditure for maintenance.

Another feature which adds materially to the exterior attractiveness of British tramcars is the use of large windows and plate glass. Some of the companies are even using curved plate glass in the vestibules, producing a most pleasing effect. This is, of course, extremely expensive, but the managers using it feel that the expenditure is worth while for the merchandising value it affords.

The large windows on the sides of the cars can be used, because in many cases longitudinal seats are employed, and in others the cross-seats are placed without respect to their position relative to the windows. These large windows are usually fixed on the lower deck, but can be dropped on the upper deck, and they are fitted with pantograph sash balances. With the plate glass no sash are used, the glass itself simply sliding in felt-lined grooves in the posts.

The hand brake is still the main service brake on British tramcars. Nearly all of them are equipped, however, with magnetic track brakes, which for the most part are used for emergency stops only, or on steep grades. In two or three places a rail brake operated by hand is being used, and Edinburgh is trying the application of air to the track brake. In Sheffield a wood block (poplar) is being used on the rail brake rather than the usual cast-iron block. While some extra caution must be exercised with the wood block in wet weather, the management feels that it is satisfactory and it practically eliminates the wear on the



The Edinburgh Corporation Tramways car, shown at upper left, represents the latest design in Great Britain

The front exit door is a feature first introduced on these Edinburgh cars. Smoking is permitted on the upper deck as on all British trams.

Top right, stair and platform arrangement to permit front exit from both upper and lower deck. The motorman has to step aside to allow passengers to come down these stairs at the front end.

Lower left, lower deck. This view shows longitudinal wooden seats, fixed window glass, upper sash ventilation and general appearance of the lower deck interior.

Lower right, upper deck. The reversible slat seats have a single board back supported by two steel straps which provide a certain springing of the backs. The sash on this deck drop.

rail. The metal block used in most of the British cities causes a very serious wear on the head of the rail, which is a matter of some concern to the management. An accompanying sketch shows the increase in wear of the rail at heavy stopping points in comparison with the wear between stopping points on rails which had been hardened by the Sandberg process.

New Paris Tramcars Depart from Customary Mechanism

ON THE Paris surface lines some of the cars are of double-deck design, but the majority are single deck, and the company is not building any more of the double-deck type. Similarly, the tendency in design here is away from the double-truck type to a single-truck car of rather unusual wheelbase, namely, 11 ft. 10 in. Furthermore, the tendency is to do away with the truck altogether and mount the two axles in pedestals attached directly to the car body underframe. The reason given for favoring the single-truck car was that the double-truck type costs more to maintain. The step to do away with the truck on the single-truck car was taken as a means of reducing the weight.

Paris cars are all of the double-end type with center entrance, and one-half of the car is designated as first class and the other half as second class. This is the only place visited by the committee where an effort was made to have different classes of travel on the tramways. Standing space in the car, including the loading well, carries the second-class rate.

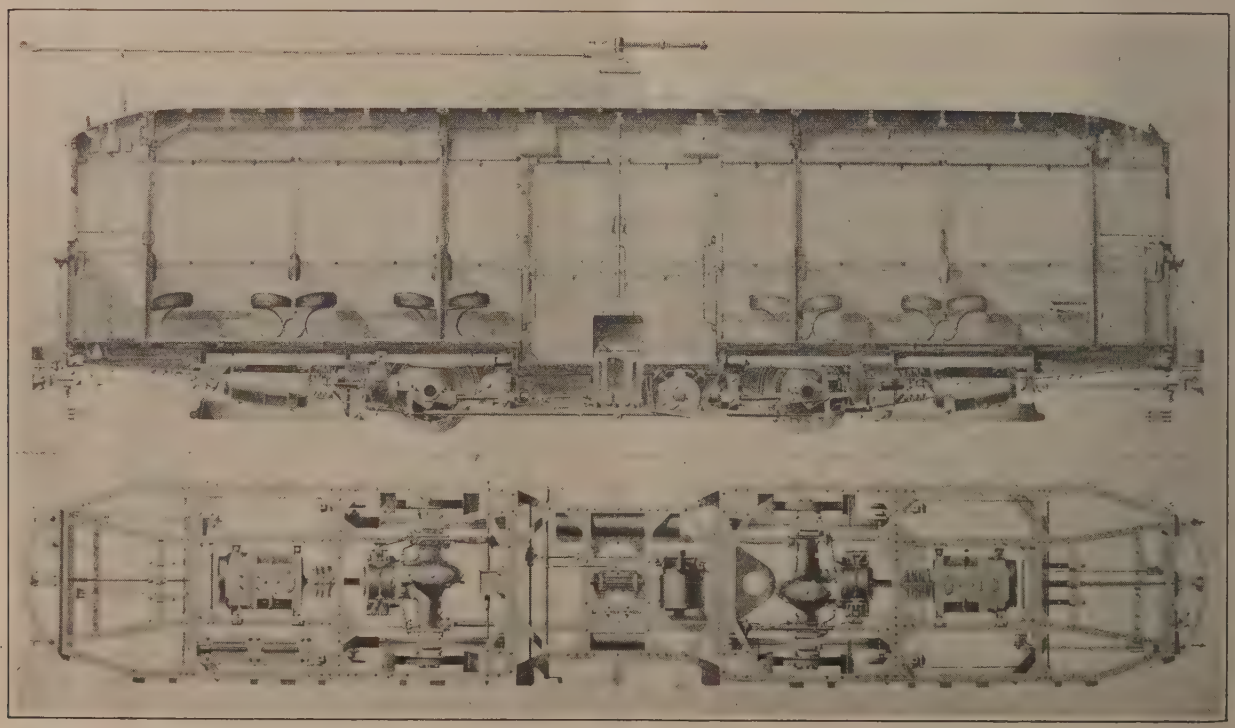
The thing which interested the committee most in connection with the Paris tramway was the new type of car* with which the management has been experimenting for some time and now has 100 in operation.

*A description of the sample car of this design appeared in ELECTRIC RAILWAY JOURNAL, Dec. 2, 1922, page 878.

Assembly of motor, drive shaft and axle unit on testing stand, showing particularly the two flexible couplings and the transmission brake

They feel at the present time that this new design will be their future standard car. The unique feature is that the two motors are mounted on the body and mechanically connected to the two axles by means of a driving shaft, flexible coupling and beveled gears—a drive somewhat similar to that of an automobile. The axles, however, conform to standard railway practice, as they are of the solid type made of nickel chrome steel. The wheels and the driving gear are all pressed on.

Each axle and pair of wheels are assembled in a unit comprising the gears and gear housings, a short length of driveshaft, a transmission brake-drum assembly and the pair of semi-elliptic springs and shackles through which connection to the body is made. One of these units may then be fairly readily removed and another put in its place in case of mechanical trouble. The shackles, by means of which the axle assembly is fastened to the body, are made up of two plates of spring



Sectional drawings showing the arrangement of mechanism on the new Paris cars, having two motors mounted on the body and connected to the solid axle through drive shaft, two flexible couplings and bevel gears

Latest type Paris tram with the motors mounted on the body framing and with axles directly attached to the body through semi-elliptic springs and shackles

Note first and second class compartment designation. Length of car, 35 ft.; wheel base, 11 ft. 6 in.; seating capacity, 30, and weight, 25,350 lb.

steel. These permit of a certain amount of lateral motion and assist the car in rounding curves. The driving force in the wheels is transmitted to the car body through two radius rods, one at either end of the axle housing.

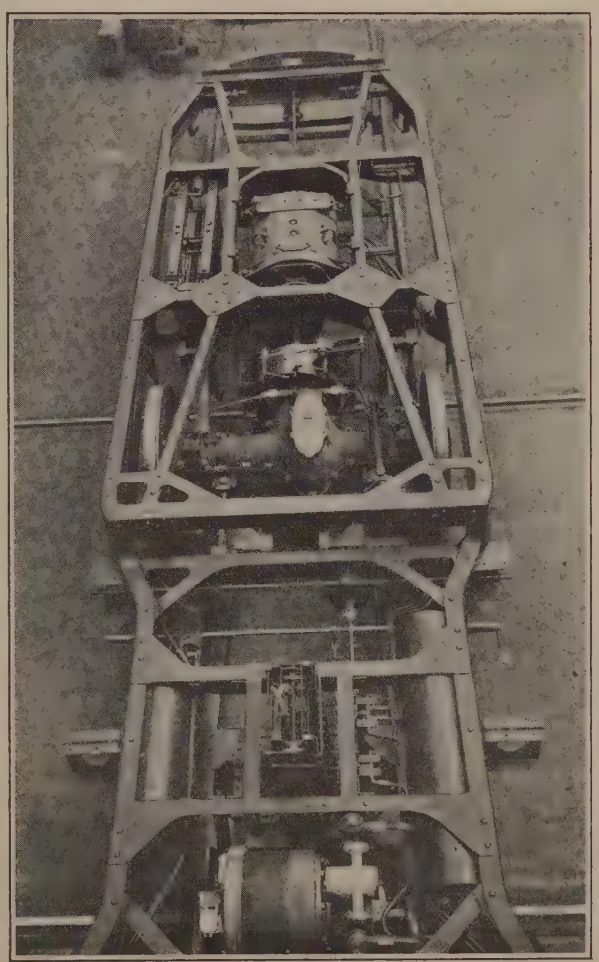
The connection between the axle assembly and the motors comprises a piece of shafting about 30 in. long with a universal joint at each end; in other words, one universal adjacent to the motor and one adjacent to the axle end. These universals, or flexible couplings, are made up of seven rings, each consisting of three plates of ⅛-in. thick chrome nickel steel, with 1-in. separator blocks placed at 180 deg. and alternated 90 deg. on adjacent plates.

Each of the motors is of 55 hp. capacity and is bolted direct to the underframe of the car body. One motor drives one axle and the other motor the other axle, each independent of the other. There is an arrangement for taking up the end thrust of the driveshaft, so that it does not all come on the armature bearings. The housing for the driveshaft on the axle is arranged with a ball and socket joint which keeps the gear and pinion properly in mesh regardless of any slight lift in the axle due to wear in the journal bearings.

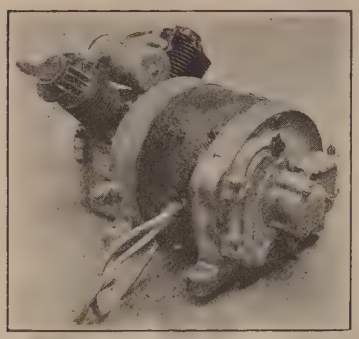
Inside journal bearings are used with lead-bronze bearings. The bearing housing can be dismantled under the car for renewal of the bearing metal by simply removing four bolts.

The transmission brake drum mounted adjacent to the axle housing, already mentioned, is used as the main service brake, and the brakeshoes on the wheels are used for emergency only. This brake band is of steel and about 10 in. wide. Four cast-iron brakeshoes, on which pressure is applied by means of air, clasp the drum and are very effective in stopping the car. The band brake was used as the service brake because it is easier to adjust. It was claimed that it required adjustment only once in fifteen days, whereas the ordinary wheel brakes require almost daily adjustment. It was also claimed that the life of the brakeshoes on the band brakes was from 40,000 to 50,000 km. (25,000 to 30,000 miles), while the life of the regular brakeshoe applied to the wheel is only 2,000 to 3,000 miles.

The air pressure employed on the band is 5 kg. per square centimeter (71 lb. per square inch). The maximum speed at which these cars operate is 50 km. per hour (31 m.p.h.) and the maximum acceleration is approximately 50 cm. per second per second (1.11 m.p.h.



Underframe of the body, new Paris cars, showing the assembly of the motors, axle units, plow housing and gearless air compressor



Gearless air compressor, 1,000 r.p.m., developed by the Paris tramways for use on the new cars

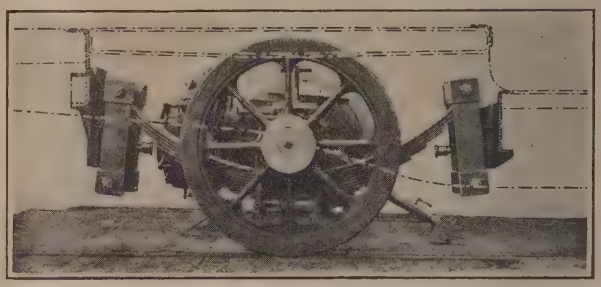
per second). The maximum running speed allowed by law in Paris is 25 km. per hour (15.5 m.p.h.). This applies to buses as well as tramways.

On these cars having the motors mounted on a car body, the armature speed of the motors is 800 r.p.m., which compares with a speed of 500 r.p.m. for the motors mounted in the usual way. This, of course, assists in reducing the weight of the motor per unit of horsepower. It was also claimed that it was easier to remove and replace a motor when suspended from the body than when it is mounted on the truck.

Another mechanical feature of this car is that it is equipped with a newly developed type of air compressor, whose weight is about one-third that of the ordinary gear type, assuming that the same motor is used. This new type of compressor is of gearless design, which rotates at 1,000 r.p.m. and delivers 20 per cent more air per unit of time than does the geared type. It delivers air at a hotter temperature (about 80 deg. C.) but it operates less frequently. Further details of the design of this compressor may be noted from the accompanying illustration.

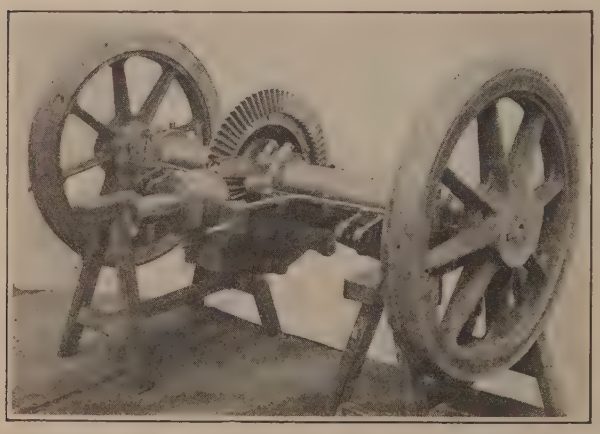
The car bodies are largely of wood construction except for the steel underframes. They seat 30 and have room for 19 standees, making a total capacity of 49 passengers. The length of the car over all is 10.65 m. (35 ft.) and the wheelbase is 11 ft. 6 in. The weight of these cars fully equipped is 11,500 kg. (25,350 lb.). The weight of the standard single-truck car of the same seating and standing capacity and the same over-all length is 14,000 kg. (30,860 lb.). The mounting of the motors on the car body and the other changes in mechanism involved would therefore seem to indicate a saving in weight of about 2,500 kg. (5,510 lb.), which is 17.8 per cent. The unsprung weight in the older type car is 2,800 kg. (6,170 lb.), while the unsprung weight in the new cars is 1,900 kg. (4,190 lb.). The reduction in unsprung weight thus amounts to 900 kg. (1,980 lb.), which is 32.1 per cent. Looking at it another way, the unsprung weight with the old type car amounted to 20 per cent of the total weight, while with the new car the unsprung weight is 16.5 per cent of the total weight.

The management of the Paris tramways is sufficiently satisfied with the results obtained from the experimental cars of this design to expand the experiment to a scale which will give an extensive operating experience with the new design. Whether the new design will show ultimately better economy and have operating advantages in general is a matter that can be told only in the future. However, from a mechanical point of view, the design offers possibilities that can be watched with interest wherever it is practical to make use of light single-truck rolling stock.



The axle unit of the latest Paris trams. The semi-elliptic springs, spring shackles and radius rods are clearly shown

An interesting type of buffer forms a part of the equipment of these new Paris cars. This consists of four straps, $\frac{3}{8}$ in. x 6 in., of spring steel, mounted to function as a semi-elliptic spring, with the inner leaf ends forged in oblong loops, through which the vertical supporting bolts extend. These bolts are carried in two forged brackets attached to the platform end sill. This spring type of buffer absorbs any shock or collision up to its capacity and tends to relieve the strain on the car body. The length of the spring buffer between brackets is about 5 ft. The spring buffer has been of material assistance in reducing the damage to the car body in minor collisions.



The solid axle assembly with upper part of housing removed, showing the ball and socket joint for keeping gear and pinion in correct mesh

Rapid Transit Rolling Stock

THE most striking thing observed with respect to the newest cars of the London Underground System was their inviting and attractive appearance. A real effort is being made to attract patronage by providing a more comfortable, pleasant ride. Large plate glass windows, a brightly painted, well-lighted interior, and figured or striped plush upholstered seats, give the cars a most inviting appearance as one sees them from the station platforms. Probably more than usual credit is due the designers because of their accomplishment in producing cars of such marked interior attractiveness, despite the difficulties and limitations placed upon them by the clearances in the small bore tubes through which many of the cars must operate. This fact also largely accounts for the peculiar exterior appearance.

The Paris subway cars are well painted, are fitted with plate-glass windows and curved plate glass at the

One of the latest steel cars built for use in tunnel lines by the London Underground

ends of the cars, they are well lighted, and the first-class cars are fitted with red leather upholstered seats. Altogether they present a very pleasing appearance, though with not the degree of luxuriousness nor comfort that impresses one in the new London cars.

The Paris cars have an interior seating arrangement which is designed more with the idea of providing maximum standing capacity than maximum seating capacity. The most common seating arrangement comprises cross-seats with a double seat on one side of the aisle and a single seat on the other side, and a a back to back arrangement of seats.

In a mechanical and structural way the committee thought these cars embodied no particularly interesting departures from practices here,* except the means employed to reduce noise. These are treated in a later section.

*These new London cars were treated in some detail in ELECTRIC RAILWAY JOURNAL for May 5, 1923.

A combination of longitudinal and cross seats, velour upholstering and arm rests, bright paint, shaded lamps and mahogany trim are features of this latest tunnel car of the London Underground. See also pictures on page 430

Fog Repeaters Signal London Underground Trains

ON ACCOUNT of the heavy fogs which prevail at certain times of the year the London Underground Railways use a special signal, called a "fog repeater," on those portions of the tunnel and tube lines which are out in the open. This fog repeater is especially valuable and necessary there because no "distant" signals are used. It consists of a special type of light signal equipped with a 20-watt, 16-cp. lamp behind a dioptic lens, located a proper distance in advance of the "stop" or "home" signal and wired so that it repeats the indication of the home signal.

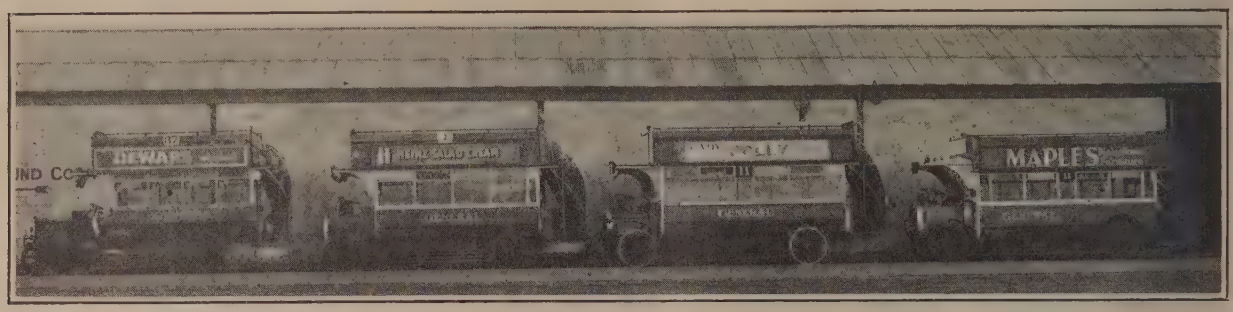
Fog repeater signal used by the London Underground

The center of the top lens is approximately 8 ft. above the track so that it is well within the motorman's line of vision. By this means the motorman is informed of the position of the "home" signal when he is a certain distance from it. The wiring is also arranged so that the towermen can put the fog repeaters in operation when fog prevails and cut them out when no fog exists.

There are 123 of these special signals in service and it is claimed that the particular type of lens in use has certain fog penetrating qualities, and that the signals have greatly accelerated movement of trains in foggy weather. The committee did not have an opportunity to see these signals in use as none of London's famous fogs made its appearance.

European Motor Bus Design

Bus Development Has Not Been Carried Forward in Europe to the Extent It Has in America, Although the Use Is Greater—The Double-Deck Design Is Coming in More and More and an Effort Is Being Made to Inclose the Upper Deck for All Weather—Light Wood Bodies Used—Weight Limitation Imposed by Department of Police



Left to right, the type B, type K, type S, and type NS buses of the London General Omnibus Company
They were first placed in service, respectively, in October, 1910; August, 1919; December, 1920, and May, 1923. The type B's have all been taken out of regular service and only a few of the type K are now in use. More than 1,000 buses of the NS type are in service

THE NS type bus of the London General Omnibus Company probably represents the latest development of the bus in Great Britain. This is a vehicle which seats 50 passengers and weighs approximately 5 tons unladen (11,200 lb.). When laden, the distribution of weight between front and rear axles for a seated load is as follows: Front axle, 3 tons 8 cwt. (7,616 lb.) and rear axle, 4 tons 19 cwt. (11,088 lb.). These buses are double decked, open top, with 22 seats below and 28 above. They are 26 ft. 9 in. long over all. They are mounted on wheels 42 in. in diameter, and the only step taken to lower the body height is a "kickup" in the frame over the rear axle. The drop type rear axle is not yet a feature of European buses, They are consequently a good deal higher than most of the buses now on American city streets.

A limitation placed upon the design of buses in London is that Scotland Yard requires that the total weight loaded shall not exceed 8 tons—5 tons on the rear axle and 3 tons on the front. The police also impose other restrictions as to the width, height and length of buses, turning radius, etc. As a result, the present bus is not all that it would be if the designers had a free hand. For example, the possibilities are that the upper deck would be inclosed, and the bodies would be wider to permit of a little more generous aisle and seat width.

The bus bodies are made entirely of wood, except for a thin steel side sheathing. In fact, every possible means has been taken to keep the weight down. The seats are of the simplest slat type; there are no window sash nor window curtains; the window glass is fixed;

The NS, latest type bus of the London General Omnibus Company, which seats 50 and weighs loaded 8 long tons
Some of the new buses are fitted with velour upholstered seats on the lower deck. Note framing and bracing of the wood body and stanchions to aid the five standees permitted. Each seat on the upper deck is fitted with an oilcloth, which the passenger may place over his lap or hold over his shoulders to shed some of London's copious rainfall. The committee observed, however, that bus tops were not popular on rainy days. The L. G. O. C. is experimenting with inclosed top designs.

there is no provision for heating, and the floors are single. On some of the newer buses, the seats on the lower deck, while being of a light type, are upholstered with plush and have spring cushions. The effort to reduce the weight continues, with respect to both body and chassis. One of the recent features of this nature is the adoption of cast aluminum wheels, which saves 200 lb. per bus. Another feature is the use of wood fenders, ¾ in. thick, which are considered to be lighter in weight and cheaper, including maintenance, than pressed steel fenders.

The engines used are of the poppet valve type and 5 per cent more motors than buses are provided to take care of the maintenance program. Every engine is taken out every six months and overhauled. No starter is provided and the setting of the spark is fixed. It is considered better to have no advance or retard than to place control of this in the hands of the driver. Scintilla magnetos are used for ignition purposes and two 12-volt generators and a storage battery for the bus lighting. The charging of the battery is regulated by cutting in and out one of the generators, which is considered simpler and more reliable than the usual voltage control regulation.

Fifty-two-seat, inclosed-top double-deck motor bus

The Sheffield and Birmingham corporation tramways each has one of these new buses for trial purposes. The weight is about 20,000 lb.

All types of buses of the General Omnibus Company previous to the NS are being replaced by the new design. Its predecessors have been the type B, which was the original, the type K with seating capacity for 46, and the type S seating 54.

In other words, in the past 14 years, the design of bus in use has become obsolete three times. The oldest buses which are now in use in London, of which there are only a few remaining, have been in service only from 12 to 14 years. These are the B type. This does not mean that the life of these buses has really been 14 years, for the practice of the company is completely to rebuild every bus once a year, so that in the 14 years a bus may have had several different motors and chassis, and the body itself may have been virtually rebuilt, possibly several times. The reason for replacing the older types of buses is a question of obsolescence, mainly because of larger seating capacity in the newer types.

The corporation tramways in Sheffield and in Birmingham, England, each has an experimental bus of double-deck design with a covered top. These properties are not confronted with as severe limitations on weight and dimensions as is the London company. This

Chars-à-bancs or motor coaches used by the London General Omnibus Company for its special tour and chartered vehicle service. These vehicles are rather typical of the general design of chars-à-bancs used throughout England and Scotland

SEATING CAPACITY OF VARIOUS TYPES OF DOUBLE-DECK BUSES OF THE LONDON GENERAL OMNIBUS COMPANY, LTD.

Type, Length	Inside	Outside	Total
B	16	18	34
K	22	24	46
S	26	28	54
NS	24	26	50

WEIGHT WITH PASSENGER LOAD

GP-6	Front Axle, Lb.	Back Axle, Lb.	
B, double deck	4,480	8,960	
B, single deck	4,480	6,720	(Seats about 20)
K	5,980	9,460	
S, double deck	7,720	11,200	
S, single deck	5,980	8,220	(30 seater)
NS	7,420	11,200	

experimental bus seats 52 passengers, and except for the headroom and width, it is practically identical with the London bus. Most of the buses in use in the British cities outside London are at present single deckers, but the tendency is clearly to make the bus conform to the old standard on the horse omnibus, horse car and tram—two decks.

Nearly all of the buses in use in Great Britain are arranged for two-man operation, the necessity for a conductor being determined primarily by the zone fare system, which is everywhere in use. A few of the country buses are arranged for one-man operation.

Differing quite distinctly from the buses of London, those in Paris are all of single-deck design, but again are all arranged for two-man operation on account of the zone fare. The most interesting thing about bus design in Paris is the use of six wheels on the newer types. There are 50 of this type in operation and 1,250 of the four-wheel type. The use of six wheels made it possible to increase the seating capacity from 28 to 40 passengers, and keep within the weight limitations per wheel imposed by the police. The six-wheel bus weighs 7,340 kg. (16,185 lb.) as compared with 5,380 kg. (11,860 lb.) for the four-wheel type. The horsepower of the engine was correspondingly increased from 30 to 36, the engines being identical except for the size of the bore. In addition to the seating capacity of 28 and 40, respectively, for the four-wheel and six-wheel bus, a standing load of 10 for the four-wheel bus and 8 for the six-wheel bus is permitted, making the total capacity 38 for the four-wheel bus and 48 for the six-wheel bus.

The extra pair of wheels on the six-wheel bus is added as a sort of trailer axle behind the driving axle and serves mainly to support the long overhanging rear platform. This extra axle is very much like the front axle, being connected to the body through a pair of semi-elliptic springs and with the wheels arranged to turn in spindles. In steering the bus, these wheels are turned in unison with the front wheels, being simply connected to the driver's steering mechanism by rods and levers. A particular six-wheel bus which weighed 7,200 kg. (15,875 lb.) had the following weight distribution on the three axles:

	Front Axle	Driving Axle	Trailer Axle
Weight, empty, lb.....	4,851	7,497	3,528
Loaded (48 pass.), lb...	5,512	12,128	5,512

An unusual feature of the Paris buses is that the entrance and exit is directly in the center of the rear end of the bus. The reason given for this was that it was thought that in heavy traffic an entrance and exit in the usual location at the side of the platform would cause passengers to be brushed off by passing traffic. The location of the exit at the rear of the platform, however, practically forces every one to step off the bus facing backward.

Paris is the only place visited by the committee where an effort is made to provide two classes of transportation on buses and tramcars. Here the front end of the bus body is divided off by a partition and the space in front of this devoted to first class passengers, while the space to the rear of it and the standing room on the rear platform is second class.

The Paris police impose a rather unique obligation on the operators of buses looking toward the protection of pedestrians. This consists of a scheme for eliminating to a large extent the spattering of water by the hard-tired wheels. The bus wheel rims are made wide enough to give space to install at the outer edge of each wheel 1 in. from the outer edge of the tire a thin rubber mud ring or flange which is a little smaller in outside diameter than the outside diameter of the tire. When the tire is under compression as it comes in contact with the pavement, this mud flange is practically in contact with the pavement also, and any water thrown out by the tire tread is intercepted by this flange.

All Paris buses are equipped with these flanges and the officials seem to be satisfied that they accomplish the purpose intended.

As to tires used on buses, the great bulk of the work is done with hard tires. Virtually all double-deck and single-deck buses used in city service are equipped with solid tires, and only a part of the buses used in cross-country work are equipped with pneumatic tires. In general, it may be said that the use of pneumatic tires in Europe is still in the experimental stage, and not developed quite as far as in America.

Steam Buses Unsuccessful

There has been quite a little talk in America about the use of steam buses in England. On investigation, the committee found that there are at present no steam buses in operation, though three or four different companies have undertaken in the past to give transportation service with vehicles of this type. All of these companies have failed and gone out of business. Some of these were quite sizable undertakings. The National Steam Omnibus Company had 60 buses in its fleet. It ceased operation three or four years ago mainly because of boiler trouble. The Metropolitan Steam Omnibus Company operated 40 buses on city and suburban routes and went out of business about eight years ago. These buses burned oil.

The only steam operation of road vehicles now going on is that of numerous manufacturers, railroads and trucking concerns which employ the steam lorry (truck). This is nothing but a small-sized steam threshing engine, with a vertical or horizontal boiler projecting out in front in full view. The fuel used is coke. The steering is just like that on a traction engine with worm and gear and a heavy chain attached to the two ends of the axle. The steering is done by one man and the engine controlled and boiler fired by another. Lorries of this rather crude type are very extensively used in the cities throughout Great Britain, particularly for heavy material haulage work. All reports gathered indicate that they are very successful and economical, taking into account that they haul from 5 to 10 tons and, in addition, often pull one to three loaded trailers.

Gasoline-Electric Buses on Trial

The London General Omnibus Company has had in use for about 9 months 166 gasoline-electric buses manu-

Six-wheel bus, of which the Paris tramway, bus and boat management has 50 in service forming part of a fleet of over 1,300 buses

It seats 40 and stands 8. The extra pair of wheels is on a trailer axle and the wheels steer in conjunction with the front wheels. Note rubber flange at outer edge of each wheel, which is supposed to prevent spattering water on pedestrians.

factured by Tilling Stevens Motors, Ltd. The principal difference between these buses and the standard London bus is that the usual gear box and clutch are done away with, and an electric generator and motor substituted therefor. The principal advantage of this type of drive is the smoothness and rapidity of acceleration. The noise and jerks of gear shifting are done away with.

The performance data available were not very complete, but it is expected that the principal saving, if there is any, will come from lower maintenance cost owing to the easier starting conditions. In London, on account of the greater weight of the gasoline-electric drive, it is necessary to reduce the seating capacity to 48, in order to keep within the limitations set by Scotland Yard. This reduces the earning capacity of the bus slightly and militates against its adoption, unless the maintenance saving is larger than is now anticipated by the L. G. O. officials, based on the limited present experience. The committee agreed that the gasoline-electric bus rides notably smoother during the acceleration period than the London gear-box bus, but its speed on hills is lower owing to the characteristics of the electrical drive.

This type of bus is also being operated to a limited extent as an experiment by the Birmingham Corporation Tramways. This company reported that the acceleration performance of the Tilling Stevens bus is ideal and approaches that of steam vehicles. The petrol (gasoline) consumption is greater than with the ordinary mechanical drive, the bus drives easier, and the tires give a longer life. This company was of the opinion that the total cost of operation, however, will be more than with the usual gear-box type bus. The Birmingham & Midland Company, large cross-country bus operator, has used gas-electric buses exclusively for years, but they have not shown any notable economy.

In general, the committee was unable to find any particular enthusiasm for the gas-electric type bus among the operating people.

Trackless Trolley Design in Experimental Stage

Trackless trolley design in Europe at the present time is largely a matter of experiment, different ideas being worked out in nearly every city in which they are in operation. Some of the designs are quite unique. The tendency in Great Britain is to make the trackless trolley of double-deck design, following out the general practice with trams. Some managements have considered that in this respect the trackless trolley had an inherent advantage over the motor bus, as its lower center of gravity made a double-deck design safe where there was doubt about this quality in a double-deck motor bus. However, inclosed double-deck buses are now being tried out and give promise of meeting requirements.

Types of trackless trolleys used in three English cities

At left, type of double-deck trackless trolley used with good success in Birmingham to replace tram line on narrow street where riding was good and street too narrow to permit double tracking. In center, Leeds trackless trolley with low floor and motors mounted on front axle. Overhead double-trolley intersection where loop in downtown section is completed. At right, Leeds Corporation Tramways trackless trolley with the two motors mounted on the front axle and each driving one wheel through internal gears mounted on each wheel. This driving scheme permitted a stepless floor level and a double-deck design.

In Leeds, with double-deck trolley buses, the two driving motors are mounted on the front axle, one in front of the axle and one behind it, with each motor driving one of the front wheels through an internal gear mounted on the wheel. To steer the vehicle, it is necessary to turn the entire axle with its load of motors about a center pivot. In order to do this, it was necessary to have a very low gear ratio in the steering mechanism and consequently it is very difficult for the driver to make any quick or short turns.

The management claimed that the front drive avoids excessive weight on the rear axle and makes it possible to bring the body down to a height which provides a stepless lower deck and permits a double deck height within the clearance limits existing in Leeds. It was also said that it avoids the trouble which had been experienced in previous designs with the differential on the rear axle. It was also considered superior to the type installed in 1911, which had a double chain drive.

Six-wheel trolley bus built as experiment by Bradford Corporation Tramways to get weight per wheel down sufficiently to permit of the double-deck body

The latest design of trolley bus in Bradford, England, employs six wheels, with the four-wheel truck at the front of the bus. The drive is a single 70-hp. motor mounted on the body or chassis with a single chain drive. The idea of using the two pairs of wheels in front was to get the load per wheel down within the limit specified by the local police. The four front wheels carry 50 per cent of the load, and all four front wheels steer on somewhat the same principle as an automobile. This trackless trolley weighs 7 tons (15,680 lb.) and was claimed to be making an average schedule speed of 9.6 m.p.h. on one route under very light traffic. It has about the same maximum speed as the tramcar. Two sets of brakes are provided, the hand brake engaging drums on the rear wheels and the foot service brake engaging a transmission drum by means of blocks. In addition to this six-wheel trolley bus, which seats 59 passengers, the Bradford company has 20 other trackless trolleys of various types.

The 12 trackless trolleys in use in Birmingham, England, are of double-deck design, seating 52 passengers and weighing, laden, 9 tons (20,160 lb.). They are driven with two 35-hp. motors mounted on the body and connected by driveshaft to the rear axle. The control of power to the motors is through a hand controller very similar to the type employed on a tramcar.

Noise of Operation

THE committee observed that in Great Britain the tramcars seem to be more quiet in their operation than the street cars in America, speaking generally. Without going into the subject exhaustively, the committee concluded that the principal reasons for this were as follows:

In the first place, all tramcars are almost totally of wood construction, which makes them inherently more quiet than if built of steel. The cars and the track are in better mechanical repair, as a whole. Special attention is given to keeping all parts of the car bodies and trucks tight and free from rattle. The window sash are largely fixed, and heavy plate glass windows also reduce the vibration and the transmission of noise.

Similarly, track joints and special trackwork are kept in first-class condition. On the majority of properties visited, bad joints were almost wholly absent, and the cars made almost no extra noise while passing over special trackwork. The fact that most of the tramways use some sort of pitch filler between the base of the rail and the concrete foundation may possibly contribute something to the lower degree of noise. Corrugation is also kept down, though this is a source of considerable expense and trouble to all of the British tramways. The cars are of lower weight than ours, and the speed of operation is lower. The rate of acceleration is slower, the maximum running speeds are lower, and the general impression gained is one of leisurely schedules. All these factors have a bearing on the noise of operation.

The London Underground organization has done a great deal of investigation work trying to reduce the noise for the riders on the tube and tunnel lines. They feel that the result obtained is not commensurate with the effort and expense involved and not up to expectations. The wood finish of the newer steel cars on which special attention was given toward obtaining noiselessness, the use of insulating material in the roof and sides, fixed windows with plate glass and ventilators with a special tortuous passage are the features which have helped most and which probably will be continued. Other experimental measures taken, such as shrouding the trucks in leather hoods, have been abandoned because they interfere with inspection and maintenance and were too expensive for the results obtained.

Probably the most important factor in reducing the noise is that the windows are fixed in the closed position, which is practicable because London has no extreme temperatures of either cold or heat. The seats are also all of a fixed wood frame construction, having no movable parts to become loose. Similarly, there are no curtain fixtures, and many other miscellaneous fittings found in most American cars, which can become loose and add to the general rattle if proper attention is not given to them, are absent. In fact, it is notable that a great many of the fixtures and features which add to the comfort and convenience of passengers in

America are totally absent on all forms of transportation in Europe.

"The Quiet Rubber-Tired Bus"

The popular idea in America is that to substitute rubber-tired buses for street cars will bring about a great reduction in noise. However, the committee was impressed with the fact that in the central London area, where there are no tramways, the noise of the buses caused by gear shifting, the exhaust and other motor noises and the pounding of bus wheels in depressions in the pavement is very bad. It was also noticed that on streets over which both tramcar and bus operate, where the noise of both types of vehicles could be directly compared, the buses on the average made more noise than the tramcars. London buses are more noisy than our modern buses and the tramways there are less noisy than our street railways. Nevertheless, the committee feels that American people are going to be disappointed in their hope that the use of buses will mean any particular reduction in street noise. And the noise of our street cars in many cities can be materially reduced by adoption of more thorough maintenance practices with respect to cars and track.

Kinds and Rates of Fare

THE zone system of fares is in use on tramways, subways and buses in all of the cities visited. The only exception is the flat fare which prevails on the underground lines in Paris. The most common minimum rate is a ride of 1 mile for 1 penny (2 cents). Glasgow has the lowest rate with an average zone length of 1.13 miles for a ¾-penny token. The most interesting thing about these fares to an American is the very high proportion of the total riders who pay only the minimum fare. Nearly 50 per cent of the riders, as seen in the accompanying table, pay only 1 penny. This reflects the closely built-up nature of most of the European cities.

Low as the minimum fare is, many of the tramways are required to give a return trip ticket to a workman for a fare as low as one-half the normal minimum for the two-way ride. This applies for rides taken boarding up to approximately 8 a.m. There are also a great variety of other special tickets, particularly in London, which offer cheaper rides during certain parts of the day or over certain parts of the system or for other special conditions of riding. The Sheffield Corporation Tramways, for example, has a minimum fare of 1 penny, but a passenger can ride all the way from or to the center of the city for 2d. The London County Council Tramways and the Underground Group tramways in London, as well as some other tramways, have

AVERAGE DISTANCE FOR MINIMUM FARES FOR TRAMS AND PETROL BUSES

	Tram		Petrol Bus	
	*Minimum Fare	Distance for Minimum Fare (Miles)	Minimum Fare	Distance for Minimum Fare (Miles)
London General Omnibus Company	....	....	1 d.	1
London Underground Group Tramways	1 d.	1	..	....
London County Council Tramways	1 d.	1-1¼	..	..
Glasgow	(a) ½ d	1 13	..	..
Edinburgh	1 d.	1	1 d.	.87
Leeds	1 d.	1	....	..
Bradford	1½ d.	2	..	..
Sheffield	1 d.	1	1 d.	¾
Manchester	1 d.	1½	1 d.	¾
Birmingham	1 d.	1½	1 d.	1
Paris—First class	45 cent	1 stage (b)	45 cent	1 stage (b)
Second class	30 cent	1 stage (b)	30 cent	1 stage (b)

* By statutory provision workmen (all riders boarding cars before 8 a.m.) get a return ticket, good any time during the day, for a single fare.
(a) Use a token for the minimum fare.
(b) Not known whether the stages, upon which tram and bus fares in Paris are based, are of the same or different length.

a special rate of 2d. all the way which applies for passengers boarding the cars between 10 a.m. and 4 p.m. When these mid-day fares were put in force on the London County Council Tramways in 1920 as a means of dealing with competition, as nearly as it could be determined, there resulted an increase of about 60 per cent in traffic, which yielded about 20 per cent increase in revenue.

Of course, in all these cities, the normal fare increases with the length of ride up to 5d. and 6d., and even 9d., as in Glasgow, according to the size of city and length of route. In London, the fares go up to 1s. (24 cents) and occasionally even more. In America, as the average ride taken on a street railway is about 3 miles, this would mean a fare of about 3d. or 6 cents. This is lower than the average in American cities, but it should be borne in mind, as the committee found, that the density of population is higher than in our cities and the hourly wages of trainmen and tramway employees generally in Europe are now only from one-third to one-half as much as they are here.

The zone system necessitates that a ticket be issued to every passenger and punched by the conductor to indicate the distance for which the fare is paid. This ticket is retained by the passenger; the conductor does not collect it nor examine it as the passenger gets off. The only check on the honesty of the passenger is the occasional check-up by inspectors, a considerable force of whom is employed for this purpose.

With the large passenger load handled by each conductor and the frequent turnover of his load, it is impossible for him to have any definite idea of the distance for which each passenger has paid his fare. In other words, the committee is satisfied from its own experience and observation that over-riding can and does take place. How serious it is in amount of money

PERCENTAGE OF TOTAL PASSENGERS CARRIED AT DIFFERENT RATES OF FARE, 1923–24

Tramways	¾d	1d	1½d	2d	2½d	3d	3½d	4d	4½d	5d	Total
Glasgow	21.68	35.48	26.85	10.06	3.20	1.50	0.63	0.55	.....	0.05	100
Edinburgh	.....	57.93	0.16	27.56	.....	11.18	.....	2.22	.....	0.95	100
Manchester	.....	47.16	22.67	13.78	6.30	3.37	1.72	0.65	0.45	0.43	100 (c)
London County Council	.....	56.89	0.35	27.68	0.11	5.40	.....	5.60	.....	3.63	100 (c)
Rapid Transit											
London Underground	.....	.....	10.11	16.15	2.41	12.70	19.30 (a)	.....	.....	.....	100 (b)
Motor Buses											
Edinburgh	.....	59.99	0.67	27.85	.....	7.69	.....	1.49	.....	2.31	100
London General Omnibus Company	.....	51.73	1.70	25.86	.....	10.24	.....	4.93	.....	5.54	100

(a) Includes all figures above 3d.
(b) The following additional per cent is included to make 100 per cent: Local and through season ticket passengers 16.52 per cent. Through ordinary and workmen passengers with foreign companies 22.81 per cent.
(c) To make 100 per cent an addition of 3.47 per cent is added which represents the proportion of half-fare tickets sold in Manchester; similarly 0.34 per cent is added for half fares on the London County Council trams.

General view in the Forest Gate garage, one of the newer ones of the London General Omnibus Company

lost, of course, the committee had no way of determining, but it is believed that such a system in America would be productive of large losses.

The zone system has the further serious drawback that the preparation and handling of tickets and the checking of turn-ins requires a large staff of clerks. This makes a heavy expense and involves an uncertainty in the operation, from which several of the officials expressed themselves as desirous of relief. So it may be said that the zone system has its bad features as well as its attractive features. For one thing, its use practically precludes the possibility of any one-man operation in city service—bus or tram.

The zone fare is used everywhere on buses as well as tramways. In general, the rate is a little higher, that is, the length of zone is a little shorter for the minimum fare than on the tramway. This is shown in an accompanying table of fares.

Only one class of fares is provided for on the trams and buses in Great Britain, but in Paris both tram and bus carry first and second class passengers.

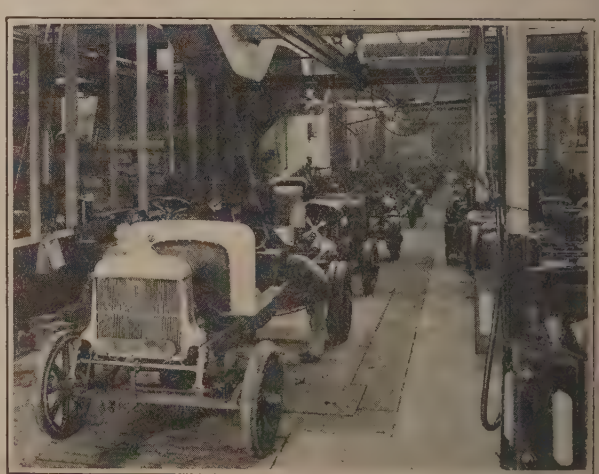
The underground lines in both London and Paris carry two classes of fares. In London, provision is made for the two classes in various ways. On some trains there are entire cars for first-class passengers, on others there are cars which have first-class compartments, and on some of the lines there is only one class of fare. The only check that a passenger riding in a first-class compartment has paid first-class fare is the occasional inspector. The collection of the first-class rate for all passengers riding in the first-class compartment is also complicated in London by the fact that when all third-class seats are full, third-class passengers may ride in the first-class section. The provision for two classes of fares is not considered a very desirable plan for underground lines by those in charge of the London operation. The first-class rate is about double the third-class rate. The third-class rate is 1½d. for 1 mile, minimum. Beyond that it is at the rate of about 1d. a mile up to 4½ miles, and then the length of zone is increased for each zone up to 12 miles, for which the rate is 8d. After that, the rate is 2 miles for 1 penny.

In Paris, the two classes of traffic are handled on the underground lines by having a separate car which occupies the central position in each five-car train, the standard unit. This car is painted red, while the other cars of the train are painted green, and this car carries a special conductor who punches the ticket of each passenger. This makes it definite that each passenger on this car has paid the first-class rate.

A flat rate of fare of 60 centimes for first-class and 40 centimes for second-class are charged, and this entitles the rider to a free transfer between the various underground lines. At the rate of exchange prevailing when the committee was abroad, these first and second-class fares were respectively equivalent to 3.3 and 2.2 cents. Because of the differences in fare, the first-class cars on the Paris subways are always more lightly loaded than the other four cars of the train.

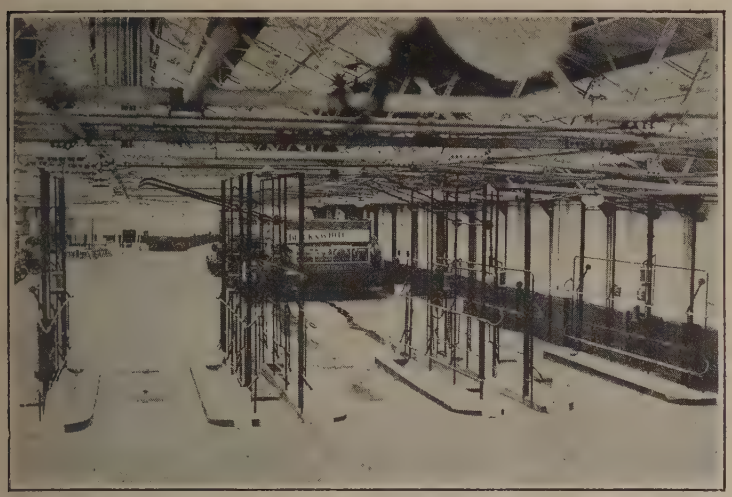
How Omnibuses Are Maintained in London

THE London General Omnibus Company has a very thorough system of maintaining and overhauling its buses. Garages are located in various parts of the city in which the buses are stored, cleaned, inspected and



At the new Chiswick shops of the London General Omnibus Company manufacturing methods are applied to the maintenance work as far as practicable

In this picture the moving floor carries the chassis along as they are assembled, giving a definite time element in which the work must be accomplished. This is typical of the work plan on each of the parts.



When buses come in from their runs in the evening they stop for a moment in these special racks, are given a quick but effective wash, moved on to their places and are wiped down

ordinary running repairs made. The majority of these garages have a capacity of 100 buses each, although the practice now is to build garages for 200 to 250 buses as all overhaul work has been transferred to and concentrated at the new omnibus repair shop known as Chiswick Works.

Upon entering a garage to be laid up for the night, each bus stops just inside the building at the gasoline and oil pumps and is filled with gas, oil and water. The crankcase oil is never completely replaced except at the overhaul periods. The used oil then removed is burned, not reclaimed. While the filling is going on a cleaner sweeps off the upper deck. From the filling pumps the bus is driven to the washrack, where fine streams of water are directed on its sides from a system of pipes in a special stand pictured herewith. Filling and washing consume but 5 minutes.

Upon leaving the washrack the bus is placed in a storage space, the windows are dried and polished, the outside of the body wiped down and the interior cleaned. In case the driver reports any defects requiring adjustment or repairs, these are attended to before the bus goes out on its run in the morning.

Every 3 weeks each bus is held in the garage for a sufficient length of time for a thorough inspection and testing of all parts of the chassis and body, including the removal of wheels to examine brake linings and bearings and special attention to the steering mechanism. The garages have several pits to facilitate this special inspection work. A running log showing the gasoline and oil consumption and all defects reported accompanies each bus that is to be so inspected, and the inspectors have this information for their guidance. The average daily mileage per bus is 118.

The new Chiswick shops, built last year to handle the total overhaul work of the company's 4,500 buses, have 13 acres under cover and employ over 3,000 hands. They will handle the complete overhaul of 85 buses a week. By virtue of the modern layout and equipment of this great works, and the application of manufacturing methods as far as practicable to maintenance work, the time required to overhaul a bus has been reduced more than half. The former practice of overhauling in the garages necessitated the driving of a bus to a coach manufacturer to shed the body, return of the chassis to the garage for overhaul, and then back again

When a bus due for overhaul arrives at the Chiswick shops this special lift raises the body off the chassis. The chassis is driven on to one part of the shop. The storage battery truck is backed under the body, which is lowered on the truck and moved to the body department

after the body. Now all the work is done at one place. When a bus has been in service for one year it is sent to the Chiswick shops for general overhauling. The body is removed from the chassis and placed in the body shop, where it is stripped of all of its equipment and fittings. Such repairs and replacements as are necessary are made and the body completely painted and reassembled with all of its fittings ready to be placed upon a new chassis. The chassis and motor are completely dismantled. Motors are overhauled on a six months schedule and 5 per cent extra engines are owned to permit this program. Each one of the parts is gaged and tested and then scrapped or reconditioned for service. Practically new chassis and motors are reassembled from the parts available in much the same manner as would be done in a manufacturing plant. After the motor and chassis have been assembled and tested a body is installed and the completed unit is ready for its final test and adjustment before it is put into service.

As a matter of fact, the overhaul of buses at Chiswick is so complete that it is difficult to say whether a unit leaving the shop is an overhauled or a virtually new bus. It really is a new assembly of reclaimed or new parts which probably were not associated together before.

The cost of complete overhaul is £212 per bus, of which about £30 is for new parts and in the nature of improvement. If no changes were made, it was thought that the straight overhaul job would cost about £150 per bus. None of the work in the shop is done on a piecework basis, but the piece-work principle is practically accomplished by the use of moving platforms and tables which introduce a definite time limit in which each piece of work must be done. The employees are aware of this policy but fall in line because the rates of pay are 5 cents an hour above the standard London scales.

Mercury Arc Rectifier Substations

THE committee inspected three mercury arc rectifier substation installations. One was serving the Metropolitan subway in Paris and was located at the Nation Station of the underground. The second one was at Berne, Switzerland, and was supplying energy to the local tramway system. The third was on a trunk line electrification and was located at the Lourdes substation of the Midi Railroad in southern France. The Midi has several such substations.

This substation at the Nation Station of the Metropolitan subway in Paris is the only one in use by that company. It consists of a pair of mercury rectifier tanks of 540 kw. each, which work in parallel and furnish direct current at 600 volts d.c. The high-tension service comes in at 5,000 volts, 25-cycle, three-phase. This substation has been in continuous operation for about one year, and the Metropolitan engineers reported that there had been no trouble and that it was very successful. They plan to install several more substations of this type in connection with subway extensions which will soon be started. The engineers reported that the vacuum is maintained without difficulty. The vacuum pump is run very little except during the peak load, when it is run continuously. It is not cut in and out automatically, but is operated as needed according to the judgment of the operators. The motor which drives the rotary vacuum pump is 0.6 hp.

In Berne the mercury arc rectifier unit consists of three tanks operating in parallel and having a total capacity of 750 kw., and delivering 550 volts d.c. It has been in service five years and has been very satisfactory. Only recently has it been necessary to open any of the tanks. In general, the operation has been so satisfactory that a new 1,200-kw. unit is now being installed in the same station.

The Lourdes substation of the Midi Railroad will have been in service two years in October, and the mercury arc rectifier here has never been touched, according to the substation operator. There are three sets of rectifiers, each having two tanks in parallel and delivering 600 kw. per set at 1,575 volts direct current. At the present time the load on the substation does not require the use of all of the units and the present plan is to change off among the sets, working each unit four days at a time. Later, with completion of the electrification work, the load will require two pairs in continuous use and there will be one spare unit.

The high-tension line coming into the Lourdes substation supplies power at 60,000 volts, 50-cycle, three-phase. This is stepped down to 12-phase, 1,425 volts. The vacuum pumps here are run for 2 hours out of each 48 hours, and it was said that this maintained the vacuum satisfactorily.

Two men are kept on duty in this substation continuously. While the committee was in the station, short circuits occurred out on the line twice, which caused the circuit breaker to open. The process of putting the unit back on the line was most simple and there was no difficulty about it. A large choke coil on each d.c. feeder line formed a part of the substation equipment. The substation operator said that two or three shorts out on the line occurred daily, but these had caused no difficulty with the rectifier equipment.

We understand that up to date the first cost of the equipment for a mercury arc substation is about the same as that for a rotary converter substation, due principally to the high development costs which must be absorbed on a comparatively few installations. The feeling seems to be that when the mercury arc rectifier is placed on a commercial basis the cost will be appreciably less than for rotary converter stations.

Operating Characteristics of Trams Compared

IN THREE accompanying tables an endeavor has been made to present some of the principal statistics covering the operations of the tramways in seven of the English cities visited, and to compare them with the conditions in comparable cities of the United States. For the purposes of this discussion, London is excluded, as it is rather a special case, just as New York is in this country.

To the American the outstanding feature is the density of population. In evidence of this the number of people per square mile is approximately 36 per cent greater than in the American cities selected of about the same size, and therefore the track mileage needed to serve a given population is correspondingly reduced. In addition, the practice in Great Britain has been less liberal than in America as to the amount of track constructed per unit of area served. The combination of these two factors has resulted in a condition which gives American cities approximately 2.75 times greater mileage of track per unit of population and nearly twice the mileage per unit of area. This

SOME COMPARISONS OF RAILWAY OPERATING CONDITIONS BETWEEN SIX BRITISH AND SIX AMERICAN CITIES OF SIMILAR SIZE

City	Population of City	Population Served	Area of City Square Miles	Population per Square Mile (City Only)	Track-Miles per 10,000 Population Served	Miles of Track per Square Mile of Area in City	Rides per Inhabitant Revenue	Rides per Inhabitant Revenue and Transfer	Rides per Car-Mile Revenue	Rides per Car-Mile Revenue and Transfer	Average Speed	Average Length of Ride, Miles
Glasgow	1,034,074	1,422,336	30	34,470	1.78	8.42	302		14.5		7.57	1.29
Edinburgh	420,281	420,000	51	8,241	1.71	1.40	284		12.3		8.50	1.53
Birmingham	919,438	(b)	68	13,521	1.43 (d)	1.91	256	No	†12.2	No	8.30	1.44 (e)
Manchester	730,551	1,000,000	34	21,487	2.29	6.76	298	Trans-	14.1	Trans-	(b)	1.49
Sheffield	519,239	524,200	49	10,596	1.61	1.71	278 (c)	fers	14.0	fers	(b)	1.38
Leeds	466,700 (a)	557,000	44	10,607	2.14	2.68	249				7.77	1.51
Average				16,486	1.82	3.61	278		13.4		8.03	1.44
Boston	748,060	1,200,000	47.8	15,649	4.43	11.13	318	363	7.05	8.06	9.2	
Cleveland	796,841	1,000,000	56.6	14,078	4.14	7.32	301	414	7.86	10.83		
Baltimore	733,826	800,000	91.9	7,986	5.43	4.74	295	422	6.55	9.36	8.3	
Washington	437,571	450,000	69.2	6,323	5.44	3.54	333	433	6.78	8.80	8.7	
San Francisco	506,676	545,000	46.6	10,872	6.73	7.80	471	611	7.65	9.93	9.1	
Milwaukee	457,147	495,000	25.8	17,718	3.81	7.24	263	371	6.88	9.68	9.5	
Average				12,104	4.96	6.96	330	436	7.13	9.44	8.96	3*

* Estimate used by the Committee on Mail Pay before Interstate Commerce Committee as representing average street railway conditions for the whole country
† Birmingham tramway figures include trolley bus figures. (a) Estimate—June, 1922. (b) Figures not available. (c) Tramway only. (d) City only (e) Tramway figure includes motor bus.

factor profoundly affects the transportation problems in the two countries.

The riding habit as measured by the number of annual revenue rides per capita is a little higher for America. But as no transfers are issued abroad and as a "transfer" passenger there pays another fare and is thus counted twice, perhaps it would be more logical to compare riding habit on the basis of total rather than revenue rides here. On this basis the riding per inhabitant in the six American cities shown in the table is more than 50 per cent greater than in the British cities. This of course is again a direct result of the greater track mileage per unit of population and per unit of area. There is another important difference, too, that in England and Scotland approximately 50 per cent of the passengers ride less than 1 mile,

OPERATING STATISTICS OF TRAMWAYS, TRACKLESS TROLLEYS AND MOTOR BUSES IN SEVEN BRITISH CITIES

Note: English money was converted into American money on the basis of £1=$4.85

	Glasgow	Edinburgh (a)	Birmingham	Manchester	Sheffield	Leeds	London (London County Council Tramways Only)
Annual report for year ending	May 31, 1924	May 15, 1924	Mar. 31, 1924	Mar. 31, 1924	Mar. 31, 1924	Mar. 31, 1924	Mar. 31, 1924
Miles of tramway—route	129.75	36.65	71.235	124.55	46.02	89.26	164.14
Miles of tramway—single track	252.85	71.83	130.41	229.93	83.82	117.98	324.50
Miles of bus routes	.....	35.25	(b)	(b)	(b)	(b)	.....
Number of tram cars	1,088	329	658	830	371	362	1,962
Single deck	.....	.....	.....	.....	.....	.....	50
Double deck	1,088	329	658	830	371	362	1,912
Number gas buses and chars-à-bancs	.....	88	79	25	53	8	.....
Single deck	.....	80	78	10	52	(b)	.....
Double deck	.....	8	1	15	1	(b)	.....
Number of trackless trolleys	.....	.....	12	.....	.....	14	.....
Single deck	.....	.....	.....	.....	.....	.....	.....
Double deck	.....	.....	12	.....	.....	14	.....
Car-miles operated:							
Tramway	29,645,098	8,162,330	17,861,137 (d)	20,927,291	10,357,352	10,119,964	64,118,565
Bus	.....	1,857,535	2,179,439	543,618	(b)	158,067	.....
Passengers carried:							
Tramway	430,226,561	100,394,122	219,263,263 (d)	294,555,618	145,708,494	(b)	689,015,086
Bus	.....	18,939,780	16,524,739	3,823,355	(b)	(b)	.....
Gross receipts:							
Tramway	$11,306,076	$3,201,892	$6,630,671	$8,929,280	$4,114,368	(b)	$21,286,350
Bus	.....	643,536	689,089	169,205	468,891	.....	.....
Operating expenses, excluding taxes:							
Tramway	$9,496,192	$2,348,149	$4,603,995	$6,286,891	$3,006,742	.....	$18,631,922 (f)
Bus	.....	576,534	529,186	146,140	355,124	.....	.....
Operating ratio:							
Tramway	83.13	73.38	69.43 (d)	70.40	73.07	(b)	87.53
Bus	.....	89.58	76.80	86.37	75.73	(b)	.....
Taxes (corporation income tax)	$197,003	$138,983	$169,588	$191,901	$93,327	$163,443	$180,060
Passengers per car-mile:							
Tramway	14.5	12.3	12.2 (d)	14.1	14.0	.....	10.75
Bus	.....	10.2	7.6	7.0	.....	.....	.....
Gross receipts per car-mile:							
Tramway	38.1c.	39.2c.	36.8c. (d)	42.6c.	39.57c	.....	33.07c.
Bus	.....	34.6c.	31.6c.	31.0c.	.....	.....	.....
Operating expenses per car-mile:							
Tramway	31.9c.	28.7c.	25.6c. (d)	29.9c.	28.9c.	.....	28.94c.
Bus	.....	31.0c.	24.0c.	26.8c.	.....	.....	.....
Seating capacity:							
Tram	.....	60	54 and 70	70 and 82	70	56	78
Bus	.....	s.d.25	s.d.–25 d.d.–52	s.d.–25 d.d.–52	s.d.–25 d.d.–52	.....	.....
Trackless trolley	.....	.....	d.d.–52	.....	.....	d.d.–60	.....
Passengers per mile of track	1,771,390	1,407,460	1,681,376	1,281,072	1,738,350	.....	2,123,326
Passengers per mile of route:							
Tramway	3,315,607	2,740,014	3,078,023	2,364,997	3,166,199	.....	4,197,779
Bus	.....	537,298	(b)	(b)	(b)	.....	.....
Gross receipts per mile of track	$46,551	$44,888	$50,845	$38,834	$49,086	.....	$65,598
Gross receipts per mile of route:							
Tramway	$87,132	$87,388	$93,082	$71,692	$89,404	.....	$129,686
Bus	.....	$18,256	.....	.....	.....	.....	.....
Average fare per passenger:							
Tramway	2.60c.	3.09c.	2.94c. (d)	3.01c.	2.79c.	3.05c.	3.01c.
Bus	.....	3.23c.	4.17c.	4.40c.		.....	.....
Rides per capita	302	284	256	298	278 (c)	249	(b)
Average speed, miles per hour:							
Tramway	7.57	8.50	8.30	(b)	(b)	7.77	9.49
Bus	.....	8.25	(b)	(b)	(b)	(b)	.....

(a) Edinburgh—Tramway figures include one month's operation of the old cable system now electrified. (b) Figures not available. (c) Tramway only. (d) Birmingham—Tramway figures include trackless trolley figures. (e) Estimate—June, 1922. (f) Figures include net expenditure on renewals charged to revenue account. (d.d.) Double deck. (s.d.) Single deck.

and the average ride is less than 1½ miles. In America the proportion of long riders is much greater and the average length of ride is more like 3 miles.

The average speed in the British cities is approximately 8 m.p.h., while the average speed in the six American cities is about 9 m.p.h.

The number of riders per car-mile, which is one index of the intensity of use of the facilities, is considerably higher than in America, averaging 13.4 as compared with 9.4 here.

Another favorable condition for transportation service abroad is the effect which the short routes have in reducing the number of cars and hence the investment required to provide the service. Combined with this is the universal use of the double-deck car, providing seating capacities of 50 to 80 passengers, as compared with the average of 40 to 60 in America. As a result, substantially fewer cars are able to handle an equivalent number of riders abroad than in America.

The cost of bus operation per bus-mile seems to be about the same as per car-mile for the trams, but the relative capacity of the two vehicles is about 3 to 1 in favor of the tram, since virtually all of the buses outside of London are single deckers seating about 25. The fares generally on the buses are higher than on the trams. They are about 50 per cent higher in Birmingham, twice as much in Manchester, and in Edinburgh and Sheffield the rate is about 15 per cent greater than on the tram in the same city.

Trunk Line Electrification Progress

THE committee spent some time in studying the electrification of trunk line steam railways in France and Switzerland.

The Paris-Orleans Railway is electrifying approximately 200 kilometers (125 miles) of line between Paris and Orleans with overhead trolley carrying 1,500 volts and a transmission line voltage of from 80,000 to 90,000. About twenty years ago approximately 20 miles of line in the suburbs of Paris was electrified with the 600-volt third rail system. Some of the trains on the 600-volt electrification are handled with electric locomotives and the remainder are made up of multiple-unit cars. The 600-volt section will be changed over to 1,500 volts in accordance with the standard adopted for all French railway electrification.

The Midi Railway in southern France is being electrified with overhead trolley carrying 1,500 volts d.c. The transmission line voltages are 60,000 and 150,000. The point of particular interest on this property is the use of the mercury arc rectifier substations which are spoken of in another portion of the report.

The electrification of the Federal Railways of Switzerland is progressing quite rapidly and the decision has definitely been reached that all future installations will be single phase with a trolley voltage of 15,000. The early three-phase installations have been satisfactory, but it is desirable to adopt one system as standard so that equipment will be interchangeable. The committee rode on electric locomotives on both the three-phase and single-phase electrifications, making the trip from Berne to Thun on a single-phase locomotive, from Brigue to Sion on a three-phase locomotive and from Sion to Lausanne on one of the new single-phase locomotives. The line from Sion to Lausanne represents the latest type of single-phase construction and the type which will be used for future electrification. The electrification of this line is now under construction between Lausanne and Geneva. The committee was especially well impressed with the overhead construction on this line* and the performance of the new locomotives.

Trunk Line Operation Compared

STEAM railroads in England and Scotland differ from those in the United States in many particulars. The committee spent some time in studying the operation, equipment and roadway of these railroads. There seems to be quite a general impression among American visitors abroad that the passenger trains run at higher speeds than in America, but that the speed is not noticed due to the smoothness of the roadbed. The observations of the committee indicated that the maximum speeds on the British railroads are not higher than on the American railroads, but that very good schedule speeds are made due to elimination of stops and slowdowns. The distances are comparatively short and the traffic between the various centers of industry heavy, so that express trains are operated without a stop between these cities and also between these cities and London.

The railroads are constructed on rights-of-way which are protected from all other traffic and intersecting railways or highways are almost totally at a different grade. This enables a train to get up to speed immediately upon leaving a station and maintain a high speed until the next station stop is reached. The acceleration is more gradual and the rate of braking is less severe than on most American railroads.

The track rails are supported in chairs screw-spiked to the ties and held in position in these chairs by means of wooden wedges driven in between one side of the running rail web and the chair. The rail joints are placed opposite each other and are suspended between two chairs, this construction making it possible to use a heavy fish plate which in many cases extends down below the base of the rail.

The majority of the track and special work is very well maintained so that there are few low joints and little noisy or rough special track work. This results in a smooth riding track comparatively free from noise. The smooth riding is due, in our estimation, more particularly to the high standard of maintenance than to the chair type of construction, as we rode on track of this type which was not so well maintained and was not particularly smooth or quiet.

The cars are almost entirely constructed of wood, are divided into comparatively small compartments and are much lighter in weight than cars used on American railroads. The heaviest axle loads are from 20,000 to 25,000 lb., while on American railroads axle loads of from 50,000 to 70,000 lb. each are not uncommon. The spring buffer and turnbuckle draw-bars eliminate the slack between cars, and the jerking upon starting and a great deal of the noise originating at the platform connections of American railroad cars are absent.

Particular attention is paid in the maintenance of car equipment to keeping parts tight.

The Great Northern Railroad, which is now a part of the London & Northeastern Railroad system, has been experimenting for several years with a group of

*A description and views of this latest Swiss overhead construction will be published in a later issue of ELECTRIC RAILWAY JOURNAL.

Two views of the omnibus terminal at the British Empire Exhibition, Wembley, London

articulated cars running between London and Leeds. The unit is composed of five cars with a kitchen car in the center, a third-class dining car adjacent on one end and then a third-class passenger coach. At the other end of the kitchen car is a first-class dining car and then a first-class coach. Additional third-class and first-class coaches are placed on their respective ends of the five-car unit as the service requires.

The committee rode this articulated train from London to Doncaster. The distance from London to Doncaster of 155½ miles was made in 3 hours and 3 minutes, or an average of 50.2 m.p.h. The return from Doncaster was made over the same line on a train made up of cars not articulated, in 3 hours and 10 minutes—practically the same running time. The conductor on the articulated train said that while this was a particularly good piece of track he thought that the articulated cars rode better than their standard cars. The test unit had been in service for three years and had been so satisfactory that five more units are being built and will be placed in service shortly.

It was the opinion of the committee that the articulated cars, both coach and diner, rode noticeably smoother than the standard coach in which the return trip was made. The articulated design seemed to have the effect of damping the oscillations of the cars, so that the lateral motion was more gentle and less noticeable. This company has also constructed and is using a number of two-car articulated units in its suburban service in and out of London.

Condition of Axles Systematically Reviewed

MANY equipment engineers have been endeavoring to place a limit upon the life or service of car axles and it is of great interest to know that the engineers of the London Underground lines have adopted a definite plan for the renewal of car axles.

All axles are grouped into classes by manufacturer and number of the heat of the steel from which they were manufactured. Unless removed on account of mechanical wear or damage, axles are allowed to run for 500,000 miles, whereupon 3 per cent of each group of axles is withdrawn from service. The axles in this lot are then subjected to the same physical, chemical and drop tests as cover the purchase of new material.

If all of these test axles withstand the test satisfactorily, those remaining in service are allowed to run for another year, at the end of which time another 3 per cent are removed and tested. If, however, any one of the 3 per cent of axles removed fails under any one of the tests applied, a second 3 per cent of this heat and group would be immediately removed from service and tested. If one of these second 3 per cent should fail, the whole heat or group would be removed and scrapped as quickly as possible.

The examination of the axles continues year after year in this manner until a failure is found, or until the axles have run one million miles, when they are withdrawn from service anyway.

A Terminal for 450 Buses an Hour

ONE of the largest transportation projects undertaken by the London General Omnibus Company was in connection with the movement of passengers between London and the British Empire Exhibition at Wembley during the past summer. While the service supplied by the Underground lines and the railroads was of an excellent nature and the great bulk of the people traveled that way, nevertheless a surprisingly large number, considering the distance, patronized the buses.

In order to facilitate the loading and unloading of passengers at Wembley the company paid £1,000 rent to the exhibition management for a large area of ground and equipped it with suitable platforms, shelters and route destination signs to serve as a terminal. The total cost of the work was £5,500, but £3,000 was paid back to the bus company for work done in behalf of the exhibit. The capacity of this terminal was such that from 330 to a maximum of 450 buses per hour are dispatched from the terminal. Altogether the number of buses operated on various routes to and from the exhibition ran as high as 958 on some of the "bank" holidays.

Pass Helps Situation in Bradford, England

THE pioneer installation of the weekly pass, as we know it in this country, was made in Bradford, England, last April 1. At that time there was considerable agitation for a reduction in the rate of fare, which was a minimum of 1½d. for 2 miles. The demand was for a reduction to a minimum of 1d. The management succeeded in retaining the 1½d. fare by introducing the weekly pass with the saving it provided for frequent riders. The sale of passes averages about 12,000 per week, which means that 17 to 18 per cent of the total passengers use passes. Revenue has increased £4,900 from April 1 to July 1, but to offset this, additional service has had to be operated because of the pass, costing at the rate of £10,000 per year additional over the service given prior to the inauguration of the pass. In other words, the pass is conceded to have cost the company a certain loss in revenue, but had it been necessary to reduce the minimum fare to 1d., this would, it is said, have cost the system £100,000 revenue loss annually.

The News of the Industry

Carmen's Plea Heard

Lively Session When Cleveland Railway Charges Duplicity—Issue Critical for Riders

The question of whether or not the Cleveland Railway will have to abide by the decision of the board of arbitration last June, raising the pay of the carmen 12 cents an hour, effective last May 1, and the question of whether the company will continue to be enjoined from putting open shop conditions into effect in the Cleveland street car system are now being considered by Judge Close of Upper Sandusky, Ohio. Hearing of the case was concluded on Sept. 15 with arguments by attorneys for both sides. At the conclusion of the oral arguments Judge Close allowed both sides two weeks in which to file written briefs. A decision is not expected before the next month.

The suit is on the application of the carmen's union to make permanent an injunction to prevent the Cleveland Railway from discharging any union men and trying to enforce open shop conditions in the city of Cleveland. The union also seeks to have the court declare the arbitration board's 12-cent wage increase legal and binding upon the company.

The company has refused to abide by this increase on the ground that J. W. Holcomb, the fifth and supposedly neutral member of the arbitration board, was prejudiced in favor of the union.

Evidence so far adduced before Judge Close shows that Mr. Holcomb, several months before being made union arbitrator, asked the secretary of the Cleveland Carmen's Union, to indorse him for the post of Federal Customs Collector in Cleveland, that the union secretary did write letters indorsing Mr. Holcomb for this post to the two Ohio United States Senators and that the secretary of the Cleveland Federation of Labor also wrote a letter indorsing Mr. Holcomb for this post. The letter of the secretary of the union indorsing Holcomb for the federal post in Cleveland was written three days before the arbitration hearings began.

The two arbitrators for the railway have also testified that they had to withdraw from the arbitration hearings because Arbiter Holcomb was distinctly hostile to the company and because of their feeling that he showed plainly that he intended to increase the carmen's wages, without regard to the evidence before the board.

Up to Sept. 11 most of the evidence submitted in the hearings had already been public property since June, when the company withdrew from the arbitration hearings and the union threatened to strike. On Sept. 11, however, the Cleveland Railway introduced dictagraph records of reported conversations of Mr. Holcomb while a guest of Fred Fields the last two weeks of August. In these records Mr. Holcomb is quoted as expressing sentiments indicating his dislike of many Cleveland Railway officials.

It is expected that the hearings will close shortly.

If the union wins its point and the court upholds the 12-cent wage increase, car riders in Cleveland will have to pay between 8 and 10 cents fare in order that the company may meet its expenses. To charge this rate of fare the present ordinance will have to be amended, as the company is now operating at its maximum rate of fare of 6 cents. If the Council refuses to amend the ordinance to permit a higher rate of fare and the company cannot pay the 6 per cent dividends virtually guaranteed under the Tayler franchise complete control of service will rest with the company itself. On the other hand, if the company wins, and if President Stanley continues to insist that the contract has been abrogated by the union, open shop conditions may prevail.

Regardless of which side wins in the lower courts, it is almost certain the case will be appealed to the Court of Appeals and to the State Supreme Court.

Chicago Negotiations Deadlocked

Unification of Lines Regarded as Essential to Successful Future Operation—Renewal of Present Franchises Suggested as Part of Comprehensive Scheme

NEGOTIATIONS between the city officials of Chicago and officers of the Chicago Surface Lines looking toward the municipalization of the properties and city management of the lines have ended. The question of price has deadlocked the conferences.

Under the terms of the ordinance of 1907, which provided for the purchase of the lines at the expiration of twenty years at the option of the electorate, the price of the lines was set at the capital account—approximately $162,500,000. This price Mayor Dever declared exorbitant. The negotiations were entered into with a view to reducing the cost to the city.

A group of bankers, representing the security holders of the lines, in a formal message delivered to the Mayor, declared they could not consent to a reduction in price. A paragraph in their letter read:

> We feel that the purchase price fixed in the ordinances is contractually binding on both the city and the companies; that the good faith of the city of Chicago is involved in the recognition and acceptance of this purchase price, and that as bankers having sold these securities we cannot recommend to the security holders that they accept any concession from the valuation agreed upon and fixed by the settlement ordinances of 1907.

The bankers further declared that the actual present value of the properties exceeds the price at which the city can buy the properties. A suggestion was made that the question of value be referred to a competent and disinterested board of appraisers. This proposal, made a number of times during the conferences of the past six months, was refused by the Mayor.

In his reply to the bankers Mayor Dever said:

> The 1907 ordinance is unsound both legally and morally. In the first place the 1907 ordinance merely gave the city an option to purchase the property at the capital account value. The city is not pledged to the acceptance of the offer. The bankers further stated that they submitted a proposal for an appraisal of the property. This is true. The difficulty of this proposal, however, was that the appraisers were to determine the "present fair value."
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> This would mean that the cost of the properties would be determined on the basis of reproduction costs at the present high prices. A constructive, alternative plan, which includes the immediate construction of subways, is to be submitted at the first meeting of the City Council.

Two days after delivering his ultimatum that the city was to go into the traction business, with elevated lines in sections now without rapid transit, buses being used as feeders and with the start of a subway, U. S. Schwartz, chairman of the aldermanic committee on transportation, began to open the way toward resumption of negotiations which the bankers had declared futile.

This was brought about through a declaration of the Alderman that the city's traction fund of $40,000,000 would go but a very little way toward the construction of a "comprehensive" system such as would be necessary if the city intended to compete with the existing lines.

John J. Mitchell, president of the Illinois Merchants Trust Company and one of the bankers representing the security holders of the Surface Lines, gave his views on the matters connected with the transportation problems of Chicago. He declared that the ideas of the Mayor were ridiculous if they were intended to improve conditions. He advocated giving the lines a forty-year franchise, now forbidden by act of the Legislature. Among other things Mr. Mitchell said:

> What the people want is service. That can be brought about only through extensions, new routes, subways and the employment of the principle of one city, one fare.
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> The Surface Lines cannot borrow capital to make improvements because their franchises expire in three years. Unification with the elevated lines, therefore, is out of

consideration for the same reason. Now I have a high regard for Mayor Dever, but his plan is ridiculous if it is aimed to improve conditions. A third system would take you nowhere and some would have to pay three fares to get to their destination. Another competitive line would draw on the revenues of the existing systems and that would prevent these companies from making the expenditures necessary for improvements.

The Mayor's plan calls for the sale of certificates which would be a lien on the property after it is created with the money borrowed from the purchasers of the certificates. People will not buy such paper. That being so, how could the city raise enough money to create an independent system large enough to give service?

We could not agree to recommend the sale of the Surface Lines for less than the $162,500,000 valuation when we know it is worth more than that today.

But even if an agreement had been reached, the voters would never approve of it, regardless of the price. The people have voted for the principle of municipal ownership, but they never have been asked to buy property to make it effective. The press is hostile to the valuation price and the owners cannot suffer the loss that would result from a lower figure.

The city and the companies should get together and ask the Legislature to remove the restriction which permits the granting of a franchise for only twenty years. To raise the capital necessary for meeting the needs of the community, the companies would have to have a forty-year grant. The city could then build subways under the loop and lease them. Unification would result and we then would have rapid and adequate transportation at a single fare.

Mr. Mitchell declared that in the event no settlement is reached before the expiration of the Surface Lines' franchise, the companies would probably petition the federal court for a receiver to continue operation of the system. He said that it is inconceivable the public would permit the tracks to be torn up and the cars shunted into the carhouses.

Detroit United Plan Approved—One-Man Cars in Port Huron

The service-at-cost plan of the Detroit United Railway has been approved by five or six municipalities near Detroit at a special election. The plan proposes construction of a double track through the six places with operation of buses. Improvements are estimated to cost $300,000 and fares will be fixed so as to give the company 6½ per cent above actual operating expenses with 2 per cent for depreciation. The municipalities which voted favorably include River Rouge, Wyandotte, Ecorse, Sibley and Trenton. Riverview will vote on the question on Sept. 20.

The agreement also provides for the formation of a board of representatives on which River Rouge and Wyandotte will have three members, Ecorse and Trenton two and Sibley and Riverview one each. This board will decide rates of fare and other questions.

At the same time the Port Huron City Commission granted permission to the City Electric Railway, a Detroit United Subsidiary, to operate one-man cars on the streets of the city. The company also is operating buses under a temporary permission. The city recently voted overwhelmingly in favor of the one-man cars. As related at length in the ELECTRIC RAILWAY JOURNAL for Aug. 16 the question put to the public was: Do you prefer one-man car operation at 5 cents to two-man car operation at 7 cents?

Interurban Bus Runs Planned

Massachusetts Electric Lines Authorized to Start Services Over Protest of Steam Railroads

Two long-distance bus lines will be started soon out of Boston, both of them to run out of Park Square. One is to be operated by the Eastern Massachusetts Street Railway from Boston to Lowell as a through line and the other is to be operated by the Boston & Worcester Street Railway between Boston and Worcester. Both services have been authorized by the Massachusetts Public Utilities Department against the protest of the railroads with which they will compete for through passenger business. The authority of the Public Utilities Department was necessary because some of the cities and towns to be traversed objected to the lines.

An important principle in connection with bus lines is established by the Public Utilities Department in its orders pertaining to these two lines. That body concedes the railroads are entitled to protection against competition, but holds that the street railways also have an interest in the passenger traffic possibilities and should not be denied a right which is open under reasonable restriction to any other corporation or individual under existing Massachusetts law.

The opinion on which the order to the Eastern Massachusetts Street Railway was based is a very interesting one and in some respects quite unusual. It follows in part:

> The company desires to operate a through bus line between Lowell and Boston and to charge a $1 fare therefor. The route in question is to a considerable extent covered under previous orders of this department, but not entirely. The Boston Elevated Railway has no objection to the Eastern Massachusetts Street Railway operating such buses in Boston, Cambridge and Arlington upon the route stated, because the latter company has agreed with the former to do no local business whatever in the three last-mentioned communities.
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> There can be no question that this additional facility is for the public convenience. This case, therefore, resembles many similar applications which have received the approval of this department except in one important and novel respect. Such express, long-distance automobile service is likely to diminish, perhaps substantially, the revenues of the Boston & Maine Railroad, which operates between the same points. It is not apt, of course, to affect regular passenger traffic on the railroad, but there can be no question that it will probably draw from it occasional, sightseeing or pleasure-riding passengers. This seems to us a real consideration, as the Boston & Maine Railroad needs all the revenue it can get. It is true, on the other hand, that the Eastern Massachusetts Street Railway also needs revenue, if it can properly obtain it. If these were the only two considerations involved, we might feel that, no matter how hard it bore upon the street railways, they ought not to invade a field which still belongs more properly to the railroads.
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> There is, however, one other factor of serious weight in this connection. It is this. There is no law which prevents any individual, firm or ordinary corporation from engaging in just this type of service and from thus competing with railroads, as well as street railways, if the necessary municipal permits are obtained. This is not only a possibility but an actual fact. There are many such lines now actively engaged in this type of competition with both street railways and steam railroads. The better way to deal with this situation, in our opinion, would be to put those individuals, firms and ordinary corporations upon the same footing as street railways and require them also to get some form of approval from this department similar to that which street railways require before being free to operate such vehicles. Unfortunately, this is not the law, and the Legislature, although this matter was called directly to its attention by a special report of the Department of Public Works, dated Jan. 9, 1924, making a similar recommendation, has deemed it better not to change the existing law and to leave the situation above described.
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> We know of no reason for anticipating a change in this legislative policy in the immediate future. If we did, we might feel differently. As it is, we must deal with the facts and the laws as they are. The controlling consideration in our minds is that we see no reason why we should refuse street railways the right to engage in this form of transportation when any individual, firm or private corporation is free to secure municipal permits without being obliged to secure our approval. While there is force in the contention of the railroad that it ought to be protected from all invasion of its proper field, we do not think that we ought to hold in substance that street railways should be excluded from an opportunity which is available to everybody else, in a case like this, where the injury to the railroad is likely to be both indirect and comparatively slight.

The order of the department to the Boston & Worcester Street Railway is similar to this one in purport.

Wages of Peoria Men Cut

A reduction of 7 cents an hour in wages to be paid car operators is provided in the award of the board of arbitration to which was referred the matter of wages by Division No. 416 of the Amalgamated Association and the Peoria Division of the Illinois Power & Light Corporation. The arbitration award was handed down on Sept. 13 after the board had been in session since May 7. The contract between the employees and the company expired on May 1, 1924. Failing to reach an agreement by negotiation, the question was left to arbitration with the understanding that a decision of two of the three members should be binding on both parties to the arbitration.

Briefly, the finding of the board was that the wages of the shop employees should remain the same; that the wages of men employed in operating the street cars should be substantially reduced, and that the new wage scale should be effective Sept. 15, instead of being retroactive to May 1 as provided by the original agreement between the company and the men.

The award was signed by L. E. Fischer, arbitration representative for the Illinois Power & Light Corporation, and W. V. Williamson, third member of the board, selected and agreed to by both the employees and the company. Henry Mansfield, arbitration representative for Division 416, did not concur in the award.

The text of the award is as follows:

> By written agreement dated May 7, the question of wages to be paid to the members of local Division 416 of the Amalgamated Association was submitted to this board for determination. After careful consideration of the evidence submitted in this case, we are impelled to believe that a substantial reduction in the wages of the men operating cars is not only necessary but justifiable.
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> We find, by reference to the contract, that the differential in wages paid to motormen and conductors operating one-man cars in excess of that paid motormen and conductors operating two-men cars is fixed at 5 cents an hour, and we assume it is not within the province of this board to change that differential.
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> The contract provides that the wages fixed by the board of arbitration should be retroactive to May 1, 1924. As four months have elapsed since May 1, it is our opinion that it will work a hardship to require a restitution for the excess of wages

paid since May 1 and that the collection of the same would be more or less difficult. We, therefore, fix Sept. 15, 1924, as the retroactive date, instead of May 1.

In view of the fact that practically all cars are now operated with one man, the fixation of the wage for two-man operation is therefore of little consequence as a whole. However, in order to carry out the provision of the contract, we find that wages for two-man operation shall be as follows: Class C, 41 cents an hour; Class B, 43 cents an hour; Class A, 45 cents an hour.

Automatically, one-man operation will be 5 cents an hour higher. This wage scale shall be retroactive to Sept. 15, 1924.

There has been little testimony offered on the subject of wages paid to shop men; in fact, so far as the record is submitted, we find little to guide us, but taking into account such testimony as was offered and our knowledge of the situation, we are of the opinion that the wage scale now paid the shop men shall be continued throughout the year, and we therefore fix the existing wage scale as the scale to be paid under this consideration.

Detroit Voters Approve Rapid Transit System

An important step forward and one which makes the rapid transit proposal in effect a reality was taken at the Sept. 9 election in Detroit when the voters approved a charter amendment providing for a system of rapid transit in the city. The result of the ballot was 136,798 in favor of the amendment and 51,308 against it. The favorable action on the ballot provided a method whereby the city will be able to proceed with the construction of a rapid transit system under a scheme for financing that will pay for the project during the course of construction, and it also provided authority for the appointment of a permanent rapid transit commission to carry out the work.

The charter amendment provides that the acting mayor is vested with power to appoint the five members composing the rapid transit commission, to whom will be intrusted the problem of completing plans for the rapid transit system, building it and placing it in operation. The terms for which the commission's members will be appointed will be from one to five years, one commissioner's term expiring each year. Appointments thereafter will be for terms of five years.

Routing plans will be prepared as the next step, it being necessary to submit the routing plan to the voters before actual construction can be begun. This next stop will probably be submitted to the voters at the spring election.

The routing plan, it is announced, is advanced to a stage where it can be perfected in time for the spring ballot, as during the past three years engineers under the present commission, which has been acting in an advisory capacity, have made studies which will enable them to complete a plan of routes this winter.

More One-Man Cars in Newark and Jersey City

More than 135 cars on three lines, two in Newark, N. J., and one in Jersey City, were placed under one-man operation by the Public Service Railway on Sept. 14. The lines operating in Newark are the South Orange and Orange lines, while the Jersey City line is the Greenville route. On the South Orange line fifty-four cars are affected; on the Orange line forty and on the Greenville line forty-three. Placing of the South Orange and Orange lines under one-man operation leaves but few of the larger lines in Newark under two-man control. Among those retaining the old system are the Broad, Roseville and Bloomfield lines. One-man operation is now in effect on all the cross-town lines, the Kearny, Harrison, Springfield, Central, Newark and Elizabeth lines.

Akron Voters Will Consider Seven-Cent Fare

A new franchise, calling for a four-year contract, is to be submitted to the voters of Akron at the general election in November. The contract has received the tacit indorsement of the City Council, although the Northern Ohio Traction & Light Company is initiating petitions to place the proposed ordinance on the ballot. The proposed contract provides:

That the company will put into effect a fare of seventeen tickets for $1, four tickets for 25 cents, seven-cent cash fare, free universal transfers.

That the company shall have the right to abandon any car line and substitute buses any time the street containing the car line is paved or repaved.

That the company shall have the right to operate double-truck one-man cars.

That the company shall have the right to establish an express bus service with consent of the city at a 10-cent fare, but such service shall be in addition to the regular service provided.

That the city has the right to order bus line extensions into undeveloped territory, but if such lines are found to be unprofitable they may be abandoned after a trial of 60 days.

That the city has the right to lease or purchase the system any year during the life of the contract, upon a 30-day notice, valuation of the property to be fixed by arbitration.

That the present car lines of the company are to be operated and in addition fourteen bus routes are to be operated.

Four thousand signatures were required to place the franchise before the people for a vote at the November election. These signatures were easily obtained. While there is some opposition to the proposal, city authorities appear to be fairly well satisfied and the prediction is made that the franchise will be ratified at the November election.

The company is now operating under a franchise which expires on May 1, 1925. The fare is 5 cents, with a 1-cent transfer charge. Under the terms of the franchise, an audit was made showing that the cost of carrying passengers during the year 1923 was 5.5 cents, excluding return upon the investment, which, according to the franchise provisions, would send the fare to 6 cents Dec. 4 in case the proposed franchise is rejected. This audit was made under the direction of the city. It was made by Ernst & Ernst and showed the cost of carrying passengers on the street cars for the year was 5.32 cents; on the buses, 6.76 cents, excluding return in both cases. The figures included taxes and depreciation.

While the figures made on behalf of the city did not include any operation during the year 1924, the company supplied the city with costs covering the period up to Aug. 1. These figures showed a heavy increase in operating expenses during the seven months of this year. In fact, the average cost per passenger for this period on both street cars and buses was 6.27 cents, with February excluded, the month when no cars were operated by the company.

Westchester Transit Problem Before H. M. Brinckerhoff

Henry M. Brinckerhoff, transit expert, has been engaged by the Westchester County Rapid Transit Commission to study the problem of traffic congestion in New York City from the angle of the Westchester commuters. In addition to railroad transportation the county commission has requested Mr. Brinckerhoff to study the part that the automobile plays in the present transit problems. Mr. Brinckerhoff is busily engaged collecting data. He has stated that the attempt to find an answer for the Westchester problem is the most difficult of all. A solution for New Jersey and Long Island, he claimed, would not be so difficult because the commuters can enter the tube at many places, while Westchesterians must come into Manhattan through an entrance that is limited as to capacity. He will consider a plan that will be practical from a railroad and financial standpoint. He will co-operate with the existing transit authorities, the board of transportation, the New York Transit Commission and the Port Authority. Mr. Brinckerhoff is a member of the engineering firm of Parsons, Klapp, Brincherhoff & Douglas, New York. He has had a long and varied experience in transit work.

Metropolitan Railway Men Will Organize

An organization meeting of the Metropolitan Section of the American Electric Railway Association will be held in the Engineering Societies Building, 29 West Thirty-ninth Street, New York City, on Tuesday, Sept. 23, at 8 p.m. The object of forming this Metropolitan Section is to foster the interests of its members and to establish cordial relations with kindred associations and between the members of the section. An election of officers will be held and afterward William L. Ransom, formerly counsel for the Public Service Commission of New York and now general counsel for the Consolidated Gas Company, New York City, and other public utilities, will talk on "Co-Operation, as applied to the Operation of Public Service Utilities." Informal discussion will follow Judge Ransom's talk. Inasmuch as this is the initial meeting of the Metropolitan Section of the A.E.R.A. it is hoped by C. E. Morgan, chairman community section committee, that all charter members, as well as all others interested in the industry, will be present.

One-Man Car Controversy Breaks Out Again in Worcester

The controversy in Worcester, Mass., over the use of one-man cars by the Worcester Consolidated Street Railway has broken out afresh. Its revival followed the move of the Consolidated placing all its lines on a one-man-car basis. This caused widespread protest, with the result that the street railway after an exchange of letters between Mayor Michael J. O'Hara and General Manager Henry C. Page agreed to run two-man crews on the principal lines during the busy part of each day. Since then much of the opposition has faded. The Consolidated's answer to Mayor O'Hara's letter brought a return of two-man cars on the main lines and a promise that further changes of that nature would be made should it prove necessary for the convenience of the public.

The letter set forth as the reason for the one-man cars on the main lines the necessity for reducing expenses to meet the advance in wages granted by the board of arbitration, together with the big decrease in traffic this year as compared to last year, due according to Mr. Page, to the business depression.

"Pass" Price Advances in Tacoma

The Tacoma Railway & Power Company, through Manager Richard T. Sullivan, has announced an increase in the price of the weekly street car pass from $1 to $1.25. The $1 pass has been in operation for 112 weeks. Sales have averaged about 12,000 weekly for some time now. The new rate becomes effective upon approval of State Department of Public Works. The traction company has repeatedly warned the citizens that unless relief was extended to the company in other directions, the $1 pass could not be continued, as it has not been a financial success in itself. The refusal of Mayor A. V. Fawcett and the City Council to permit the proposed traction ordinance to come to a vote of the people is believed to have precipitated the increase in the pass rate. The proposed ordinance provided relief for the company by removing some of the onerous franchise and paving requirements contained in the present grant.

Youngstown Jitneys May Go Back to Square

According to a unanimous decision of Ohio Court of Appeals, ordinances of the city of Youngstown regulating jitneys to points a considerable distance from the Public Square are in conflict with the licenses granted by the State Utilities Commission under the Freeman-Collister act. Judge Farr in his opinion said that the State Utilities Commission had granted the plaintiff, John H. Hogan, acting for the Youngstown Jitney Association, the right to operate over a certain route and that the City Council thereupon passed an ordinance setting the jitneys back to a certain place and refused them the right to operate over part of the route which the state had given them permission to travel. There was a conflict, he said, between the ordinance and the rule of the commission, which had, of course, the force of a state law.

Section 3 of Article 18 of the state code gives municipalities the right to have home rule and to pass such regulatory provisions as they may desire, when not in conflict with the general laws, but the Appeals Court has reluctantly concluded, Judge Farr said, that in view of the conflict in the present case the state order takes precedence over the ordinance of Council.

The decision marks another step in the battle in Youngstown between the jitneys and the railway. Youngstown operates under a service-at-cost franchise, which fact has been an aid in securing remedial legislation from the municipality so far as the latter's powers could go. This aid took the form of successive ordinance which pushed the jitneys further and further away from the Public Square until they had been made practically harmless. The latest decision apparently throws the matter wide open again.

Discontinuance Waits on Agreement with Employees

Judge Carroll of the Massachusetts Supreme Court after a hearing on the petition of Zenas W. Bliss, receiver of the Interstate Consolidated Street Railway, Attleboro, Mass., for leave to discontinue operation of the line continued the case one week to see if satisfactory arrangements could be made whereby the services of 76 employees of the company would be retained. Judge Carroll said that unless an agreement is reached between the receiver and the employees it will be his duty to grant the petition as the court cannot allow a road to be operated at a daily loss to its creditors.

Mr. Bliss told the court the wages of the employees were recently increased by an arbitration finding from 66 to 76 cents an hour. He said if that schedule was maintained it will be useless to run the road. The operating loss is now about $120 a day.

The judge inquired if there were any practical solution of the difficulty, and Mr. Bliss replied that, if the employees would accept the former schedule of wages and the road could use 100 per cent one-man cars and also a bus on some portion of the line he believed a small profit might result from such conditions.

James H. Vahey, arguing for the employees, said that the petition was pure subterfuge to set aside an award for an increase in wages honestly made.

Increased Fare in Philadelphia Blocked—No Decision Reached

The temporary 8-cent cash fare did not go into effect in Philadelphia, Pa., on Sunday, Sept. 13. A court order issued on Sept. 12 forbade the raising of the fare. The blocking of the increase was brought about through the action of Judge William B. Linn of the Superior Court. He passed favorably upon the city's petition for a stay setting aside the order of the Public Service Commission permitting the increase and making non-effective the tariff filed by the company with the commission. The matter was then deferred until Sept. 18, when five judges in the Superior Court of Pennsylvania considered the legality of the temporary increase. They listened to arguments, heard testimony and looked over an array of exhibits, statistics and documents for three hours, but unsatisfied, they adjourned to study and digest the more than 500 pages of printed record of the case. Until the decree is handed down the Philadelphia Rapid Transit Company will continue to charge a 7-cent cash fare with four tickets for 25 cents.

Mayor Rejects Brooklyn Company's Bus Offer

An offer by the Brooklyn-Manhattan Transit Corporation to operate buses for a 5-cent fare with free transfers to its subway, elevated and trolley lines for an experimental period of three months was rejected on Sept. 15 by Mayor Hylan.

The offer was made early in the day in a letter addressed to Chairman John H. Delaney of the Board of Transportation, and signed by Gerhard M. Dahl, chairman of the board of directors of the B.-M.T.

Its acceptance would have meant that the company would put buses into operation on routes covering Kings Highway, a large part of Brownsville, and a proposed Richmond Hill-Jamaica line. Passengers would have been able to obtain free transfers to and from all intersecting B.-M. T. transit lines.

It would also have meant that the results of this three months' period of operation would be used as a basis for negotiations between the city and the company for continued bus service.

The following day Mayor Hylan directed Commissioner of Accounts Hirshfield to furnish him with information concerning the value of the stock of the B.-M. T., and asked if it has not been "rigged by gentlemen in control." One of the questions the Mayor asked was: "Is there any method by which this $25,000,000 increase in value of the stocks can be reclaimed for the treasury of the B.-M. T.?" His reference was, of course, to the appreciation in the market value of the securities of the company. Mr. Dahl characterized the proposition as "really too ridiculous to discuss." It is sufficient to call attention to it.

Frank Hedley, president of the Interborough Rapid Transit Company, in a letter to Mayor Hylan and the Board of Estimate, said the Interborough is willing to "operate such buses as the public authorities deem necessary, as feeders to our subway and elevated roads for a 3-cent fare, so that for 8 cents a passenger may ride on both buses and rapid-transit lines." He suggests also buses for an 8-cent fare on streets occupied by subway or elevated to relieve congestion during rush hours and will be glad to consider free transfers from buses to rapid transit lines. He suggests a conference with the city's experts.

Financial and Corporate

Brooklyn City Income Off

Report for Year Ended June 30 Reflects Cost of Increased Service and Higher Wages

A summary of the financial results from the operation of the Brooklyn City Railroad and its subsidiary, the Brooklyn City Development Corporation, for the year ended June 30, 1924, was made public on Sept. 12. The gross revenue from transportation increased approximately $59,000 during the fiscal year. During this period the company expended for maintenance or credited to the reserve for that item approximately $2,800,000. This sum was regarded as adequate to meet all current maintenance and was an increase of $177,000 as compared with the previous year. The cost of operating cars increased approximately $246,000. This was due largely to increased service and higher wages.

INCOME STATEMENT OF THE BROOKLYN CITY RAILROAD

	Year Ended June 30, 1924	Year Ended June 30 1923
Passenger revenue	$11,774,853	$11,715,813
Other car revenue	75	150
Total transportation revenue	$11,774,928	$11,715,963
Advertising and other privileges	100,818	85,870
Rent of land, buildings, etc.	131,700	131,660
Rent of tracks and terminals	52,962	50,755
Miscellaneous revenue	2,690	2,004
Total operating revenue	$12,063,099	$11,986,252
Operating Expenses		
Maintenance—Way and structures	$1,243,751	$1,246,176
Equipment	1,584,105	1,404,317
Power	1,026,068	1,023,282
Operation of cars	4,111,427	3,865,305
Injuries to person and property	361,892	419,436
General and miscellaneous expenses	530,007	512,592
Total operating expenses	$8,857,250	$8,471,108
Net operating revenue	$3,205,848	$3,515,144
Taxes assignable to operation	849,552	889,532
Operating income	$2,356,296	$2,625,612
Non-operating income	163,160	210,941
Gross income	$2,519,456	$2,836,553
Income Deductions		
Interest	$308,158	$367,453
Rent of cars, tracks, etc.	209,578	213,884
Total income deductions	$517,736	$581,338
Net income	$2,001,720	$2,255,215

H. Hobart Porter, president of the company, explains that at the time the company resumed possession of its property its books of account reflected neither the cost nor the value of the property. To meet this condition the company on April 22, 1924, advised the Transit Commission that it proposed to set up a figure of $30,000,000 as its fixed capital account. This the officers of the company believed was a very conservative estimate of the value of the fixed capital and far less than would be established in case of rate or valuation litigation.

In November, 1923, after prolonged negotiations, a settlement of the guaranty fund controversy was made with the Brooklyn-Manhattan Transit Corporation. Under this settlement the Brooklyn City Railroad received $2,027,000 of its own bonds, being the $1,627,000 face amount of its first consolidated mortgage 5 per cent bonds and the $125,000 refunding mortgage 4 per cent bonds previously held in the guaranty fund and $275,000 refunding mortgage 4 per cent bonds in place of the $275,000 B.R.T. bonds previously held in the guaranty fund; also $387,507 of matured coupons on such bonds and interest.

These bonds are now held in the treasury of the Brooklyn City Railroad. The first mortgage bonds of the Brooklyn, Queens County & Suburban Railroad to the par value of $2,000,000 formerly held in the guaranty fund were delivered to the reorganization committee of the Brooklyn Rapid Transit Company, with the agreement that they should be returned to the Brooklyn City Railroad if the Brooklyn Heights Railroad failed to make any recovery upon the so-called "Construction Account" claim, and in the event of recovery, these bonds could be used at their face value in satisfaction of the judgment.

Since the close of the fiscal year the Transit Commission has approved the application of the company for permission to issue $4,000,000 of additional stock on the acquisition by the Brooklyn City Railroad of the rolling stock and equipment of the Brooklyn City Development Corporation and the dissolution of that company. With the Development Corporation dissolved and the cars and other equipment turned over to the Brooklyn City Railroad the directors, on Aug. 12, declared a stock dividend of $4,000,000 payable on Sept. 30 to stockholders of record Sept. 5, 1924. The owners of each three shares of existing stock are entitled to receive one additional share of stock. Script will be issued representing fractional shares.

During the year the company reconstructed 62,107 ft. of single track and replaced the old 94-lb. rail with new rail weighing 122 lb. per yard. The Brooklyn City Development Corporation received during the year 200 new passenger cars and they have proved efficient in operation and acceptable to the traveling public. Four quarterly dividends of 25 cents each were paid during the year on the stock, which is $10 par value. The company operates 231 surface electric railway lines. No statistics of operation are contained in the report.

Buys Bus Line.—The Grays Harbor Railway & Light Company, Aberdeen, Wash., has purchased the capital stock, buses and equipment of the Twin City Transit Company, operating a stage line between Aberdeen and Hoquiam.

Sale Under Foreclosure at St. Louis Likely Oct. 1

Foreclosure on the United Railways properties of St. Louis, Mo., on Oct. 1 under the terms of the indenture which secures the issue of 5 per cent general mortgage bonds of the St. Louis Transit Company looms up as likely. The Transit Company issue totals $9,790,000. It will mature on Oct. 1. With the reorganization still unsettled bankers in touch with the United Railways affairs have expressed the belief that foreclosure is inevitable. If the reorganization plans are carried through successfully it is probable that a "friendly" foreclosure sale will be conducted in order to satisfy conditions contained in the mortgage securing the issue of Transit Company bonds. The holders of that issue recently paid out of their own pockets the last semi-annual interest payment of the $30,300,000 United Railways general mortgage 4s, an issue ranking in lien before the Transit 5s.

Another six months' interest on the $30,300,000 of United Railways 4 per cent bonds will be due on Jan. 1, next. The Transit company bonds are also a junior lien on the properties of the St. Louis & Suburban Railway.

Fox River Line Reclaimed

The deal has been closed by which the Fox & Illinois Union Railway, Aurora, Ill., comes into possession of farmers and others along the line who subscribed funds to purchase the road. It had been planned to dismantle the road. Of the $40,000 subscribed $25,000 went to Arthur Evans, president of the road, in cash along with a note for $50,000, which will run five years with interest at 5 per cent. The committee will use $15,000 out of the $40,000 to pay outstanding debts.

After the conclusion of the deal at which local people took over the road officers were elected as follows: Harvey Gunsull, president; Randall Christian, vice-president; I. V. Cryder, secretary; E. S. Fletcher, treasurer; T. T. Fletcher, director.

These officers will have charge of the operation of the road, at least until a permanent organization is formed.

Sale of Famous Niagara Line Reported

The Niagara Gorge Railway, Buffalo, N. Y., extending along the lower Niagara gorge on the American side of the river from Niagara Falls to Lewiston, has been purchased by the Niagara Falls Power Company, according to reports in financial circles in Buffalo. The famous scenic line is expected to be abandoned to give way for a huge power development plan now contemplated by the Niagara Falls Power Company and the Niagara, Lockport & Ontario Power Company. None of the executives of companies reported involved in the deal will discuss the negotiations. The purchase price is reported to be approximately $2,000,000.

The Niagara Gorge Railway operates a belt line from Niagara Falls to Queenston, Ont., via the Park & River

division of the International Railway along the top of the Canadian Niagara escarpment, across the lower Queenston-Lewiston bridge owned by the International Railway and returning to Niagara Falls via a private right-of-way through the lower gorge adjoining the rapids.

The company owns a large number of old-type open and closed cars, baggage and express cars, a double-track line along its private right-of-way, several bridges in the lower gorge, a carhouse and an electric power station.

Application Made for Receivers for Oklahoma Railway

Judge F. E. Kennamer of Tulsa will hear in Oklahoma City on Sept. 29 the application of the Mississippi Valley Trust Company, St. Louis, for appointment of a receiver for the Oklahoma Railway. The action is brought in the interest of the holders of $290,000 junior mortgages which are declared due for failure of the railway to keep its city lines in proper repair. The city of Oklahoma City is seeking to intervene in the case, alleging the conditions complained about by the bondholders were caused by mistakes of management.

John W. Shartel, president of the railway, states that the receivership application is the inevitable result of the attitude of the Mayor and City Commissioners of Oklahoma City toward measures declared by the railway for the last two years as necessary if the company was to continue to operate. Mr. Shartel states that legislation regulating traffic on the streets has been promised but that the only legislation enacted has been in the interest of buses, the operation of which will further cripple the electric railway. He also states that the attitude of the city officials in filing suit for the restoration of the 5-cent fare, which suit is still pending, caused the railway to drop plans for purchasing and electrifying a railroad line from Oklahoma City to Atoka, which would have helped out the revenues of the company. The Mayor denies an attitude of hostility toward the company, but states that he will issue permits for buses whenever the terms of the new jitney bus ordinance are complied with.

The receivership application asks for authority to abandon service on eight city lines and shorten runs on practically all of the rest.

Abandonment Hinted.—Unless a division of rates on business originating on its line for off-line points that will insure profitable operation is granted, the Spokane & Eastern and the Inland Empire Electric Railway may be abandoned. This was intimated at a recent hearing before J. B. Campbell, Interstate Commerce Commissioner, and A. C. Wilkins, examiner of the commission. Representatives from large lumber interests in the district and the Cœur d'Alene Chamber of Commerce testified that a curtailment of the electric service would be extremely detrimental to the Cœur d'Alene Valley and urged any necessary revision of rates.

To Issue Stock.—Savannah Electric & Power Company, Savannah, Ga., has filed application with the Public Service Commission for permission to issue $250,000 in first preferred debenture stock. The funds are to be used for the betterment of the company's properties and the acquisition of additional properties. Hearing on the petition has been set for Sept. 30.

Deferred Installment Dividend Announced.—At the meeting of the board of the Interborough Rapid Transit Company, New York, N. Y., on Sept. 16, payment was authorized on Oct. 1, next, of the deferred installment of Manhattan dividend due Jan. 1, 1924, at the rate of $1 per share. Action on the installment for the current quarter due on Oct. 1 was deferred until next week. The dividend rental will be paid to stockholders of record at the close of business Sept. 22.

A Line Discontinued. — The Cincinnati, Newport & Covington Railway, Covington, Ky., has discontinued the line which operated between Fort Thomas and Cold Springs, Ky. The officials said it was a losing proposition. A bus line was immediately installed by private interests to accommodate residents of the outlying section.

Operation Discontinued.—The Salem, Ore., City Council on Sept. 10 granted the Southern Pacific Company, owner and operator of the Salem railway lines, permission to abandon railway service and substitute bus service. Insufficient income was assigned by the company as the reason for seeking discontinuance. The difficulties in Salem have been referred to previously in the ELECTRIC RAILWAY JOURNAL

Property Formally Taken Over.—The property of the Buffalo & Lake Erie Traction Company, operating between the Erie city limits and Buffalo, was formally transferred to the new owners at midnight on Sept. 14 and became the Buffalo & Erie Railway. The management of the line is now in charge of George MacLeod as representative of the new owners. Operating officials have been retained as follows: Superintendent, George J. Baker; auditor, H. S. Rykert; traffic manager, P. J. Gallagher; road master, C. M. Harrison; superintendent of overhead line, William Jefferson; master mechanic, Y. C. Bell; superintendent of substations, Leo Bigler; claim agent, John Pinieuski. No new operating officials have been added. The terms of the organization were reviewed in ELECTRIC RAILWAY JOURNAL, Sept. 13, page 406.

Personal Items

G. M. Dahl Made Chairman of Board

At the annual meeting of the stockholders of the Brooklyn-Manhattan Transit Corporation on Sept. 15, all of the present directors were re-elected. Gerhard M. Dahl was elected chairman of the board. He has heretofore been chairman of the executive committee. A. H. Wiggin was re-elected chairman of the finance committee, the members of which were re-elected, as were the members of the executive committee of the company.

W. E. Boileau, general manager of the Peoples Railway, Dayton, Ohio, since early in 1920, has severed his connection with that company. Mr. Boileau's experience in railroad and electric railway fields has been very broad. In 1888 he started in on electric railway work and spent a number of years constructing and operating properties in the South. He went to Dubuque in 1904, where he was put in charge of the construction of a power house, carhouse and rebuilding of tracks for the Union Electric Company. A year later he became identified with the New York, Westchester & Boston Railway, New York. At one time he was general manager of the Chattanooga Railway & Light Company, the Lookout Mountain Railway and the Lookout Incline Railway, Chattanooga, Tenn. He was appointed manager of the Scranton Railway in 1914. It was in this capacity he was serving when he was asked to accept the managership of the Peoples Railway in Dayton.

Henry S. F. Lansdown, Clive Leese, Herbert C. Davy and Alfred W. Green, all connected with the Metropolitan District Railway, London, England, expect to attend the convention of the American Electric Railway Association in Atlantic City next month.

Obituary

George W. Kuemmerlein, for fifty years actively connected with the street railway of Milwaukee, died in that city on Aug. 20, following an operation. Mr. Kuemmerlein not only saw the change from horse to electric power in Milwaukee but was an operator during the development of Milwaukee's railway systems from a few miles to the tremendous dimensions which it possesses today. Mr. Kuemmerlein was born in Germany in 1848. While he was still a boy Mr. Kuemmerlein was brought to the United States by his father. He became connected with the Milwaukee railways more than half a century ago as a driver, but was gradually promoted to the position of superintendent of transportation of the consolidated system. Mr. Kuemmerlein later resigned this position to take charge of the street railway system at Racine, also controlled by the Milwaukee Electric Railway & Light Company. He retired from this position about twelve years ago. It is interesting to note that the position of superintendent of transportation of the Milwaukee Electric Railway & Light Company is now held by his son, George Kuemmerlein, Jr.

Manufactures and the Markets

News of and for Manufacturers—Market and Trade Conditions
A Department Open to Railways and Manufacturers
for Discussion of Manufacturing and Sales Matters

Large Improvement Program Undertaken in California

Track construction and reconstruction work totaling nearly 19 single-track miles and costing $1,382,818 has been undertaken this summer by the Pacific Electric Railway, Los Angeles, Cal. In general, the construction involves the use of 7-in., 128-lb. grooved girder rail, rock ballast machine tamped, continuous joints, flat and brace tie plates, 6-in. x 8-in. x 8-ft. treated Oregon pine ties, double concealed bonds, heat-treated track bolts and Hi-power nut locks.

In Burbank it is proposed to reconstruct 4,086 ft. of single track, replacing old 70-lb. A.S.C.E. rail with the type of construction described above. An extension of 5,400 ft. in the same town will be built with 75-lb. C. S. revised section rail.

At Long Beach 970 ft. of second main track will be built with standard construction. Solid manganese 7-in., 93-lb. T-rail special work will be installed. Elsewhere in the same town 3,520 ft. of track will be reconstructed, replacing the present 60-lb. A.S.C.E. rail with 7-in., 128-lb. grooved girder rail. An extension of 6,870 ft. will also be built.

A 2-mile extension is being built between San Gabriel and Temple. The first section of this line is constructed with 75-lb. C.S. revised section rail, rock ballast, redwood ties, flat tie plates and continuous joints. A second section in paved street is being constructed with the 7-in., 128-lb. grooved girder rail.

At Redondo Beach the railway is replacing 50-lb. and 60-lb. rail with 75-lb. C.S. revised rail. At Pasadena 2,799 ft. of second main track is being built and old 60-lb. rail is being replaced by 128-lb. rail. Between Redondo Beach and Del Rey approximately 3½ miles of track is being changed from 60-lb. rail to 75-lb. rail. A storage yard with a capacity for 296 cars is being built in the vicinity of Long Beach.

In Los Angeles more than 22,000 ft. of single track is being constructed as described in the first paragraph. In this work old 50-lb., 60-lb., 61½-lb., 72-lb. and 75-lb. T-rail is being replaced. Asphalt concrete pavement is being generally used in connection with this reconstruction job.

Bids Received at Detroit on $600,000 Bus Installation

Bids for furnishing 50 or more buses for the Detroit Department of Street Railways have been opened and are under consideration by the Street Railway Commission. Four companies submitted bids. They were the Fageol Motors Company, the Yellow Coach Manufacturing Company, the Standard Motor Truck Company and the Gotfredson Truck Corporation. Two of the bidders were Detroit concerns. The Detroit companies are not considered to be manufacturers of buses, according to announcement by the Street Railway Department. Their bids, although lower than those of the two others who submitted proposals, were considered as offering a truck design modified to bus use. The buses on which bids were asked are to be double-decked with six-cylinder motors and pneumatic tires.

The Fageol Motors Company, Oakland, Cal., and the Yellow Coach Manufacturing Company, Chicago, the two outside bidders, have both placed sample buses in use in Detroit for experimental purposes. It is believed that the results of the trials with the sample buses will have considerable bearing on the decision of the Street Railway Commissioners.

The bid submitted by the Fageol Motor Company was as follows: From one to 49 buses, with fully inclosed upper deck, $12,470 each; from 50 to 74, $11,371.50; from 75 to 99, $11,072.25; 100 or more, $10,773 each. Chassis only—49 or less, $7,115; 50 to 74, $6,759; 75 to 99, $6,581.38; 100 or more, $6,403.50. Delivery is to begin within 30 days after the order is received and continue at the rate of one bus a day for the first 50. An additional 50 would be delivered within 60 days.

The Yellow Coach Manufacturing Company bid was as follows: $12,400 each regardless of number; with open top, $11,360; with semi-inclosed top, $12,000. The first bus would be delivered within 90 days, the next 10 at the rate of one a day and the next 39 at the rate of two a day; others within 60 days of the announcement of the award of the contract.

The Standard Motor Truck Company submitted a bid of $9,886 each, while the Gotfredson Truck Corporation bid $10,500 each.

Metal, Coal and Material Prices

Metals—New York	Sept. 16, 1924
Copper, electrolytic, cents per lb.	13.062
Copper wire base, cents per lb.	15.875
Lead, cents per lb.	8.00
Zinc, cents per lb.	6.163
Tin, Straits, cents per lb.	47.50
Bituminous Coal f.o.b. Mines	
Smokeless mine run, f.o.b. vessel, Hampton Roads, gross tons	$4.15
Somerset mine run, Boston, net tons	2.05
Pittsburgh mine run, Pittsburgh, net tons	1.875
Franklin, Ill., screenings, Chicago, net tons	1.675
Central, Ill., screenings, Chicago, net tons	1.475
Kansas screenings, Kansas City, net tons	2.50
Materials	
Rubber-covered wire, N. Y., No. 14, per 1,000 ft.	$6.55
Weatherproof wire base, N. Y., cents per lb.	18.25
Cement, Chicago net prices, without bags	2.20
Linseed oil (5-lb. lots), N. Y., per gal.	$1.04
White lead, in oil (100-lb. keg), N. Y., cents per lb., carload lots	0.12
Turpentine (bbl. lots), N. Y., per gal.	0.89

Rolling Stock

Cleveland Railway, Cleveland, Ohio, has been authorized by the City Council to purchase 100 new cars—50 motors and 50 trailers. One motor and one trailer are now being constructed in the railway's shops and the success of these two cars will determine whether or not all of the hundred are to be built by the railway company or purchased.

United Traction Company, Albany, N. Y., will purchase ten trackless trolleys, eight of which will be put in immediate operation. The new vehicles will cost $120,000.

Williamsport Passenger Railway, Williamsport, Pa., plans to purchase three buses.

Johnstown Traction Company, Johnstown, Pa., has placed in service three new cars, purchased from the G. C. Kuhlman Car Company. The cars are 47½ ft. long, or 7½ ft. longer than any other car of the company. The cars seat 52 persons. They are all steel and weigh 35,000 lb. each, equipped with all safety appliances, and cost $15,800.

Buffalo & Erie Company, Fredonia, N. Y., has placed an order with the Cincinnati Car Company for 18 modern interurban type cars for passenger service between Buffalo and Erie. The cars will seat approximately 41 persons. They are expected about Nov. 1. New cars for service on the Dunkirk-Fredonia line have also been ordered. This is the successor company to the Buffalo & Lake Erie Traction Company.

Illinois Central Railroad, Chicago, Ill., sent out specifications to car builders on Sept. 18 for the construction of 250 new multiple-unit cars. These will be operated out of Chicago in suburban service on the electrified division.

Brooklyn-Manhattan Transit Corporation, Brooklyn, N. Y., has awarded contracts to the American Car & Foundry Company for the construction of four three-car articulated units with delivery promised within five months. The trains are considered as samples. Two will be equipped by the General Electric Company, and two by the Westinghouse company. The General Electric equipment will consist of type 282 motors, four motors to each three-car unit, with two motors on each end truck. The control will be the G.E. PC-15 duplex; that is, there will be separate control for each set of two motors, but the pairs will be connected in multiple-unit control. General Electric CP-30 compressors will be used on each end section. The Westinghouse motors will, like the General Electric motors, be of a special design. They have not yet been designated by number as a type. The Westinghouse control also will be of special design. It will be known as UP-2. The trucks will be made by the Pressed Steel Car Company after special designs not yet designated. Each three-car unit will have a capacity of 520 passengers with a seated load of 250. The seating capacity of the end cars will be 90 and of the center car 70.